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Installation and Operation Manual
X-TMF-SLA6900-SLA6800-MFC-eng
Part Number: 541B100AAG
August, 2009

Brooks® Delta Class SLA6900 Series UHP and SLA6800 Series Metal Seal Mass Flow Controllers and Meters



Model SLA6950A
Analog I/O
Mass Flow Controller



Model SLA6950D
Digital I/O DeviceNet™
Mass Flow Controller

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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.

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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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1-1 Description

Thank you for purchasing a Brooks Instrument Delta Class Metal-Sealed Mass Flow Product. This manual, X-TMF-SLA6900-SLA6800-MFC-eng is a complete installation and operation manual for your instrument.

1-2 Purpose

The Brooks® SLA6900/SLA6800 Series are mass flow measurement devices designed for accurately measuring (MFM's) and rapidly controlling (MFC's) flows of gases. This instruction manual is intended to provide the user with all the information necessary to install, operate and maintain these products. This manual is organized into the following sections.

Section 1	Introduction
Section 2	Installation
Section 3	Operation
Section 4	Maintenance
Section A	CE Certification

It is recommended that this manual be read in its entirety before attempting to operate or repair the SLA6900/SLA6800 Series.

1-3 Description

The Brooks SLA6960/SLA6860 Series Mass Flow Meters (MFM) are high precision gas flow measuring devices. The SLA6950/SLA6850 Mass Flow Controllers (MFC) are a complete, closed-loop system for controlling flow. They are designed for use in advanced, ultra-clean gas handling systems requiring deterministic performance, superior accuracy, and diagnostic capabilities. These instruments feature ultra-polished internal surfaces (SLA6900 Series) and all metal inboard and outboard seals (SLA6900 & SLA6800 Series).

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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.

Physical:

PERFORMANCE CHARACTERISTICS:

Flow Ranges*

Models SLA6950, SLA6960, SLA6850 & SLA6860
Any range from 0-3 sccm to 0-30,000 sccm N_2 eq.
Models SLA6951, SLA6961, SLA6851 & SLA6861
Any range from 20-100 slpm N_2 eq.
Up to 200 slpm H_2 flows possible (consult factory)

***Standard: 0° and 101kPa (760 Torr). Per SEMI Guideline E12-96. For full scale flow rates greater than 50 sccm Nitrogen equivalent.**

Control Range

(50:1) - elastomeric valve seat
(33:1) - metal valve seat

Accuracy

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

Repeatability

±0.20% of rate

Temperature Sensitivity

Zero: Less than 0.075% F.S. per °C
Span: Less than ±1% F.S. shift over 10-50°C range

Settling Time

Less than 800 ms to within ±2% full scale of final value for a 0-100% step per SEMI Guideline E17-91.
(Refer to Figure 1)

RATINGS:

Operating Pressure

1500 psig maximum
150 psi (10.35 bar) maximum operating pressure recommended for optimal performance

Pressure Equipment Directive (PED) 97/23/EC

Sound Engineering Practice

Pressure Differential Range

Model SLA6950, SLA6850
5-50 psid (3.45 bar max.)
Model SLA6951, SLA6851
10-50 psid (3.45 bar max.)
Minimum and Maximum pressure drop depends on gas and FS flow rate (consult factory)

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Leak Integrity
Inboard to Outboard: $1x10^{-10}$ 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)

Maximum Fluid Operating Temperature
0°C to 65°C (32°F to 149°F)

PHYSICAL:

⚠ 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 (SLA6900 Series)
316L Vacuum Arc Remelt (VAR), 316L, and high-alloy ferritic stainless steel.
External/internal seals: Nickel
Valve seat: 316L stainless steel - standard
Internal wetted surface finish 5 Ra

Materials of Construction (SLA6800 Series)
316L Vacuum Arc Remelt (VAR), 316L, and high-alloy ferritic stainless steel.
External/internal seals: Nickel
Valve seat: 316L stainless steel - standard
Internal Wetted Surface Finish: 32 Ra

Outline Dimensions
Refer to Figures 2-9.

Process Connections (SLA6900 Series)
1/4" male VCR™
CS Seal (SEMI spec. 2787.5 4/98)
C Seal (SEMI spec. 2787.1 4/98)

Process Connections (SLA6800 Series)
1/4" male VCR™
CS Seal (SEMI spec. 2787.5 4/98)
C Seal (SEMI spec. 2787.1 4/98)

ELECTRICAL CHARACTERISTICS:
Electrical Connections
Analog I/O option: 15-pin D-Connector, male
DeviceNet I/O option: 5-pin Micro-Connector, male

EMC Directive 89/336/EC
per 61326

Power Supply Voltage
Analog I/O option: +15 Vdc, ±5%
(traditional -15 Vdc pin is ignored)
DeviceNet I/O option: nominal = 11-25 Vdc

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Power Requirements

	Watts, typ.	Watts, max.
Analog I/O option, no valve:		1.80
Analog I/O option, with valve:	2.60	4.00
DeviceNet I/O option, no valve:		3.80
DeviceNet I/O option, with valve:	4.90	7.60

Command-Setpoint Input (Analog I/O option only)

0-5 Vdc: Input will accept signals to 5.5 Vdc (110% F.S.).
Input resistance: 360 k 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)

For use with potentiometer command setpoint input
±0.2%, into 1 K ohm (minimum load)

Calibration-Select Signal (15 Pin Only)

Select one of ten gases and P.I.D. tuning settings in analog mode.

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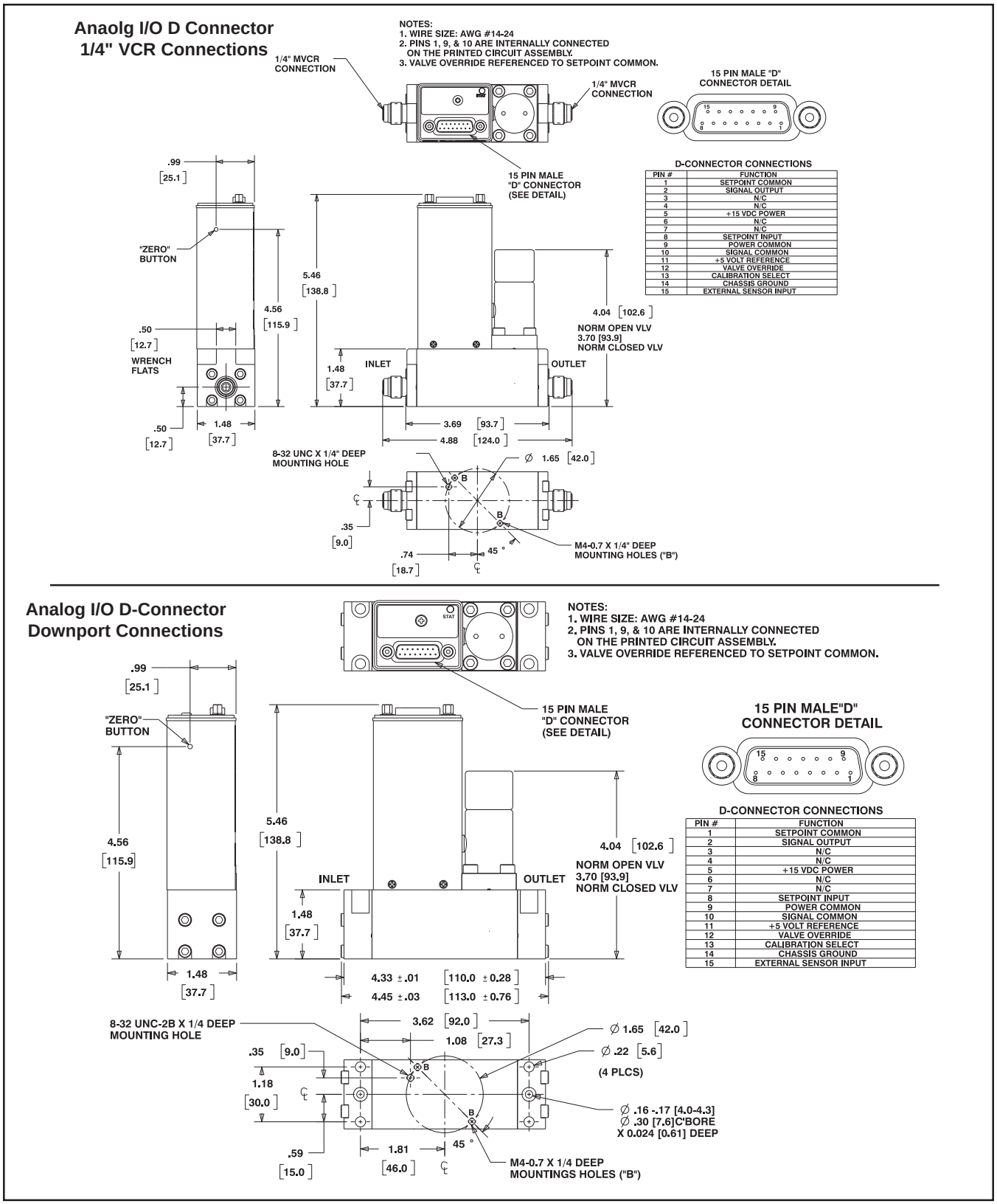


Figure 1-1 SLA6950/SLA6850 Series Analog I/O MFC Dimensions.

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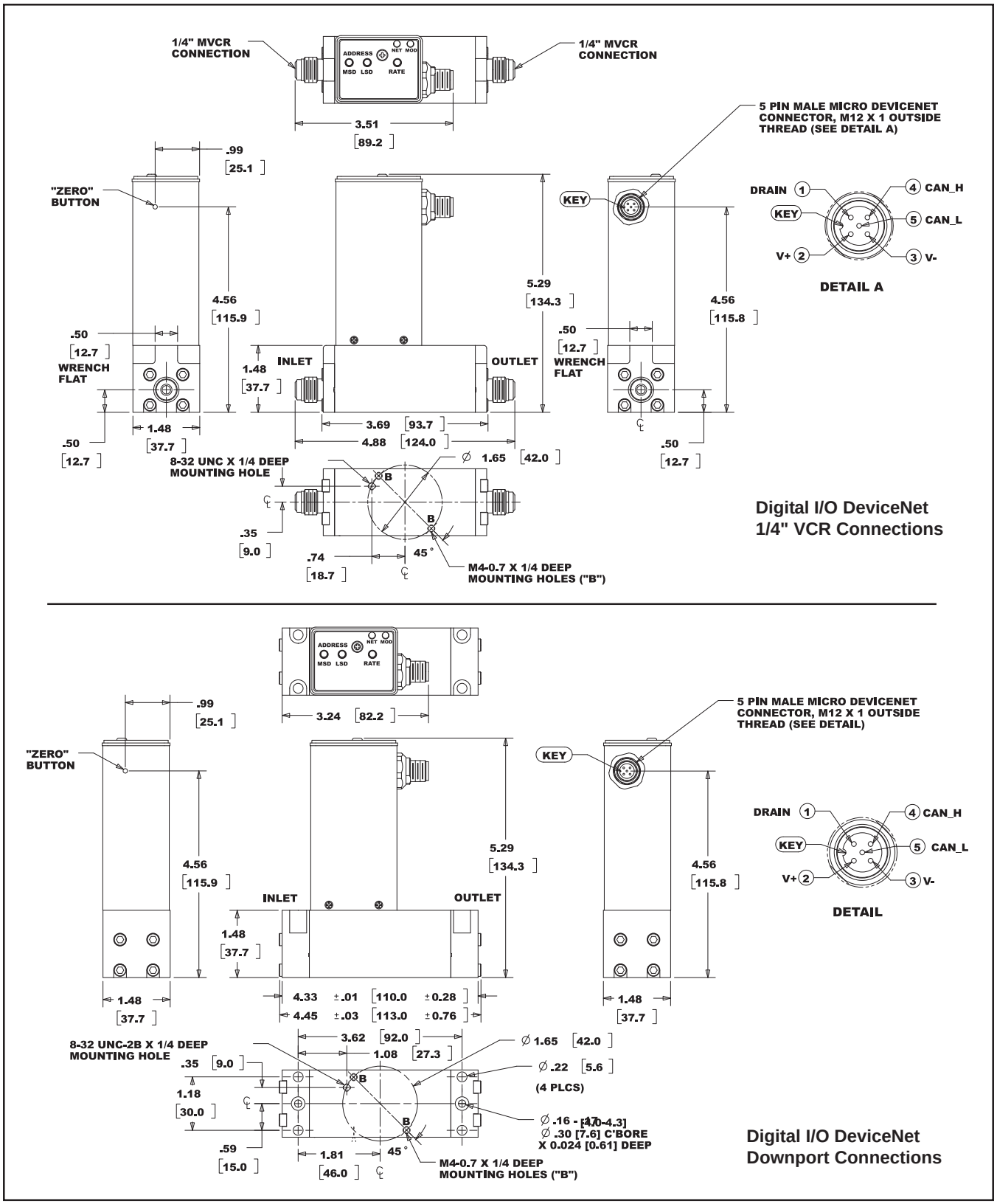


Figure 1-2 SLA6960/SLA6860 Series Digital I/O DeviceNet MFM Dimensions.

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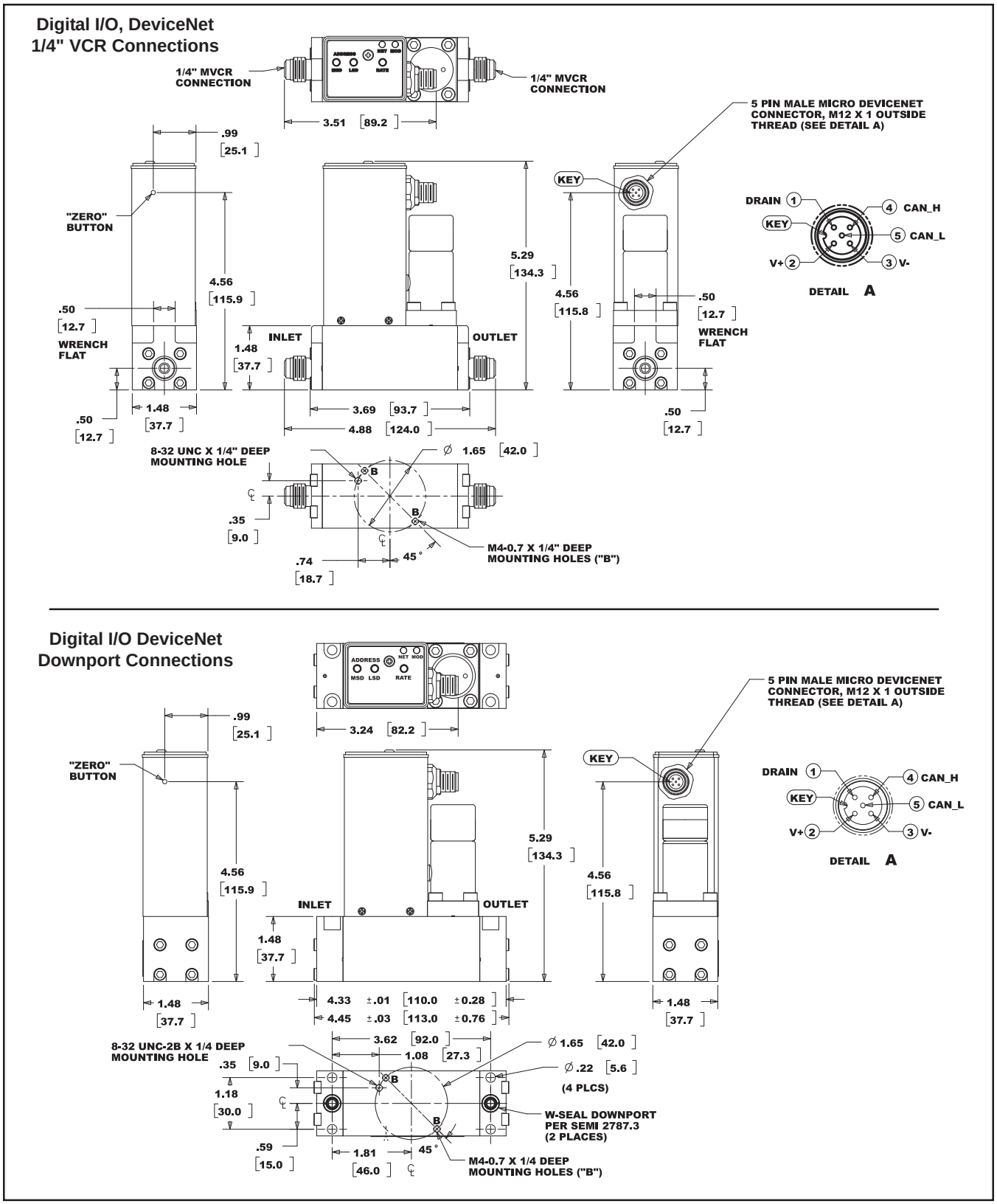


Figure 1-3 Model SLA6950/SLA6850 Series Digital I/O DeviceNet MFC Dimensions

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2-1 General

This section provides installation instructions for the Brooks® SLA6950/ SLA6850 Series MFC's and SLA6960/SLA6860 Series MFM's.
Figure 1-1 shows the SLA6950/SLA6850 Series dimensions, gas connections and electrical connection locations for the MFC's, refer to Figure 1-2 ('D" Connector) for the SLA6960/SLA6860 Series MFM's .

2-2 Receipt of Equipment

When the equipment is received, the outside packing case should be checked for damage incurred during shipment. If the packing case is damaged, the local carrier should immediately be notified regarding his liability. A report should be submitted to the Product Service Department, Brooks Instrument, 407 West Vine Street, Hatfield, Pennsylvania 19440.

Remove the envelope containing the packing list. Outside of your clean area, carefully remove the equipment from the packing case. Make sure spare parts are not discarded with the packing material. Inspect for damaged or missing parts.

The SLA6900/SLA6800 UHP Series devices have been assembled, calibrated and double-vacuum bagged in a Class 100 clean room. In your semi-clean area, remove the outer bag only. Pass Ultra-Clean Metal Seal Mass Flow Device into your clean area. Remove the second clean room compatible bag only when the equipment is ready to be tested and/or installed in your clean system.

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2-3 Recommended Storage Practice

If intermediate or long-term storage is required for equipment, as supplied by Brooks Instrument, it is recommended that said equipment be stored in accordance with the following:

a. In the original vacuum bag and shipping container.

b. In a sheltered area with the following conditions:

1. Ambient temperature 21°C (70°F) nominal, 32°C (90°F) maximum and 7°C (45°F) minimum.
2. Relative humidity 45% nominal, 60% maximum and 25% minimum.

2-4 Return Shipment

Prior to returning any Brooks equipment to the factory, contact the factory for a Return Materials Authorization Number (RMA#). This can be obtained at Brooks Instrument, Product Service Department, 407 West Vine Street, Hatfield, PA 19440, or call toll free 1-888-554-FLOW (3569).

Also, 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 meter, is required before any Brooks Personnel can begin processing the equipment. Copies of the form can be obtained at the locations listed below.

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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

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. To maintain the ultra-clean integrity, this service should be performed by the factory or one of the authorized service centers.

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2-6 Gas Connections

Standard inlet and outlet connections supplied on the SLA6900/SLA6800 Series are 1/4"(M) VCR. 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.

Recommended installation procedures:

a. The SLA6900/SLA6800 Series MFM 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 SLA6900/SLA6800 Series MFM 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.

⚠ CAUTION

Use caution when installing surface mount (downported) controllers. Most metal seals can not be reused after compression. Follow the seal manufacturers' recommendations for installation. Tighten the mounting screws in 10 in-lb. increments such that the seal undergoes uniform compression. Final torque values depend on the screw and hardware material and lubrication.

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.

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⚠ CAUTION

Since the Models SLA6900/SLA6800 Series control valves 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 acuation 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 (MFC). The filtering element should be replaced periodically or ultrasonically cleaned.

Table 2-1. Recommended Filter Size.

Maximum Flow Rate	Recommended Filter
100 sccm	1 micron
500 sccm	2 microns
1 to 5 slpm	7 microns
10 to 30 slpm	15 microns

2-9 Electrical Interface

The SLA6900/SLA6800 Series MFM's are controlled using analog 0-5 Vdc signals. The minimum set of connections which must be made to the Model SLA6950/SLA6850 MFC and Model SLA6960/SLA6860 MFM 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 SLA6900/SLA6800 Series MFM's 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 SLA6900/ SLA6800 Series MFM's PC board.

Voltage I/O Version

- Chassis Ground
- Signal Common
- Signal Output
- +15 Vdc Supply
- -15 Vdc Supply (not used by SLA6950 MFC)
- Setpoint Input
- Setpoint Common
- Supply Common

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⚠ NOTICE

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

Brooks supplies high quality cables which meet the specifications for CE certification. If you provide your own signal cable you should use a cable which is completely screened with a 100% shield. D-Connectors should also be shielded using a metal shield. If applicable, metal cable glands must be used to provide 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 an earth ground. See Appendix A for CE Certification of Mass Flow Equipment.

2-10 Operation Check Procedure

⚠ 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.

a. Mount the MFC/MFM in its final orientation.

b. Apply power to the MFC/MFM and allow approximately one hour for the instrument to warm up and stabilize its temperature.

c. Do NOT supply gas to the MFC/MFM. Ensure that the differential pressure across the MFC/MFM is zero.

d. Check the MFC/MFM zero.

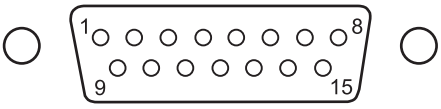
e. The analog output signal should be 0.000 Vdc ± 0.2%. If the zero exceeds one of these limits, follow the re-zeroing procedure in Section 3-5 (analog mode).

f. Turn on the gas supply. A positive flow signal may be present due to valve leak-thru (MFC only). Leak-thru may be significant (3.0%) with metal valve seats.

g. Supply a setpoint voltage between 1 and 5 Vdc.

h. Check the analog output signal. The output voltage signal should match the setpoint voltage (± 20mV) within 10 seconds after the setpoint is changed.

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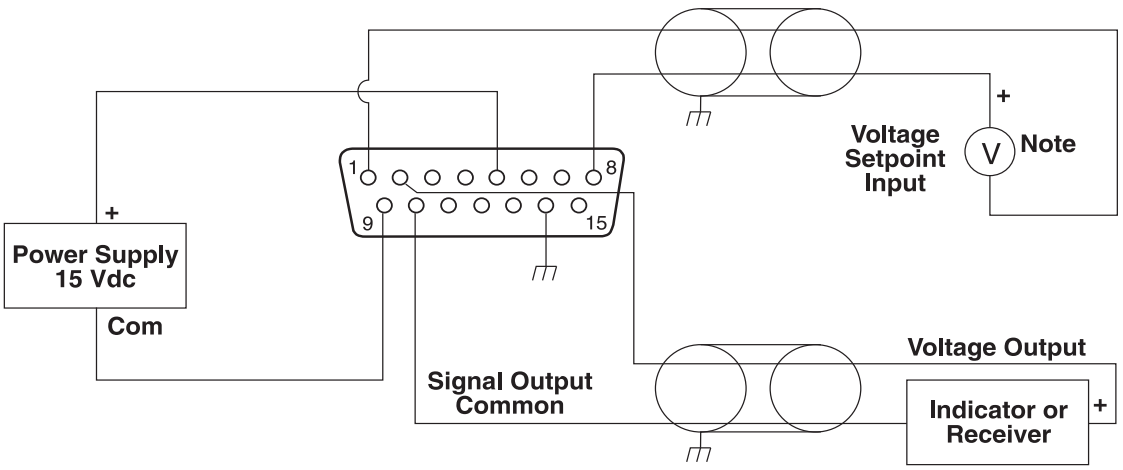


Analog I/O Pin Connections:

Signal:	15-pin D-conn	9-pin D-conn
Setpoint/Command Common	1	8
Flow/Signal Out	2	2
+15v	5	3
-15v (unused)	6	9
Setpoint/Command In	8	6
Power Supply Common	9	4
SIgnal Common, Output Return	10	7
+5v reference	11	
Valve Override	12	1
Calibration Select Pin	13	
Chassis Ground	14	
Remote Transducer In	15	
No Connections	3,4,7	5

Note:* indicates MFC's only

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



Voltage Signal: Setpoint and Output

Notes:
1. The commons for the setpoint input and signal output are not isolated from power supply common.
2. Tie cable shields should connect to ground at one end only.(MFC only)

Figure 2-2 Common Electrical Hookups.

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3-1 Overview

This section contains the following information:

- Theory of Operation
- Features

3-2 Theory of Operation for Flow Measurement

The thermal mass flow measurement system consists of two components: the restrictor and the flow sensor. Figure 3-1 contains a diagram of the flow stream through the MFC/MFM with an enlarged view of the flow sensor. Gas flow entering the MFC/MFM is separated into two paths; one straight through the restrictor and the other through the flow sensor. This is represented in Figure 3-1 where the total flow A+B enters the MFC/MFM and is separated into streams A and B. The streams are joined again at the far side of the restrictor.

The separation of the flow streams is caused by the restrictor. During flow conditions there will be a pressure differential across the restrictor which forces gas to flow in the sensor.
The pressure difference caused by the restrictor varies linearly with total flow rate. The sensor has the same linear pressure difference versus flow relationship. The ratio of sensor flow to the flow through the restrictor remains constant over the range of the MFC/MFM (A/B = constant). The full scale flow rate of the MFC/MFM is established by selecting a restrictor with the correct pressure differential for the desired flow.

The flow sensor is a very narrow, thin-walled stainless steel tube. Onto this tube are built upstream and downstream temperature sensing elements on either side of a heating element. Constant power is applied to the heater element, which is located at the midpoint of the sensor tube. During no-flow conditions, the amount of heat reaching each temperature sensor is equal, so temperatures T1 and T2 (Fig. 3-1) are equal. Gas flowing through the tube carries heat away from the upstream temperature sensor and toward the downstream sensor. The temperature difference, T2 - T1, is directly proportional to the gas mass flow. The equation is:

$$DT = A \times P \times Cp \times m$$

Where,

DT = Temperature difference T2 - T1 (°K)

A = Constant of proportionality (S^2-°K^2/kJ^2)

P = Heater Power

Cp = specific heat of the gas at constant pressure (kJ/kg - °K)

m = Mass Flow (kg/s)

A bridge circuit and a differential amplifier interpret the temperature difference and generate an electrical signal directly proportional to the gas mass flow rate.

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3-3 Features

Note: All SLA6950/SLA6850 Series mass flow controllers and SLA6960/SLA6860 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 SLA6950/SLA6850 Series is a full-featured digital MFC. The SLA6950/SLA6850 Series 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 the SLA6950/SLA6850 Series can be retrofitted into tools using analog MFCs. Other versions of the SLA6950/SLA6850 Series can provide a variety of digital protocols, for example DeviceNet.

The SLA6950/SLA6850 Series 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 SLA6950/SLA6850 Series can contain calibrations for different gases or for the same gas at multiple conditions (pressures, full-scale flow rates). Section 3-5 Analog Mode of Operation describes more information about the data contained in the calibration table and how to access the data.

Calibrations will appear in the calibration table in the same order as they appeared on the SLA6950/SLA6850 Series 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

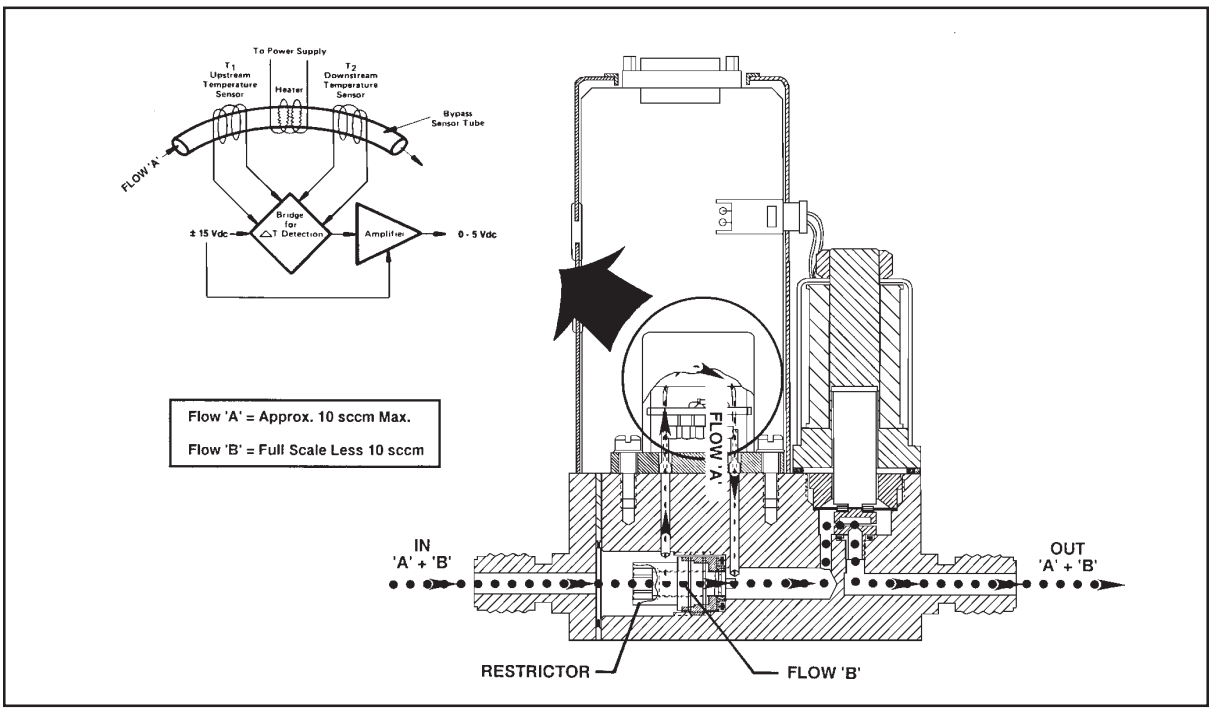


Figure 3-1 Flow Sensor Operational Diagram (VCR™ End Connections Shown)

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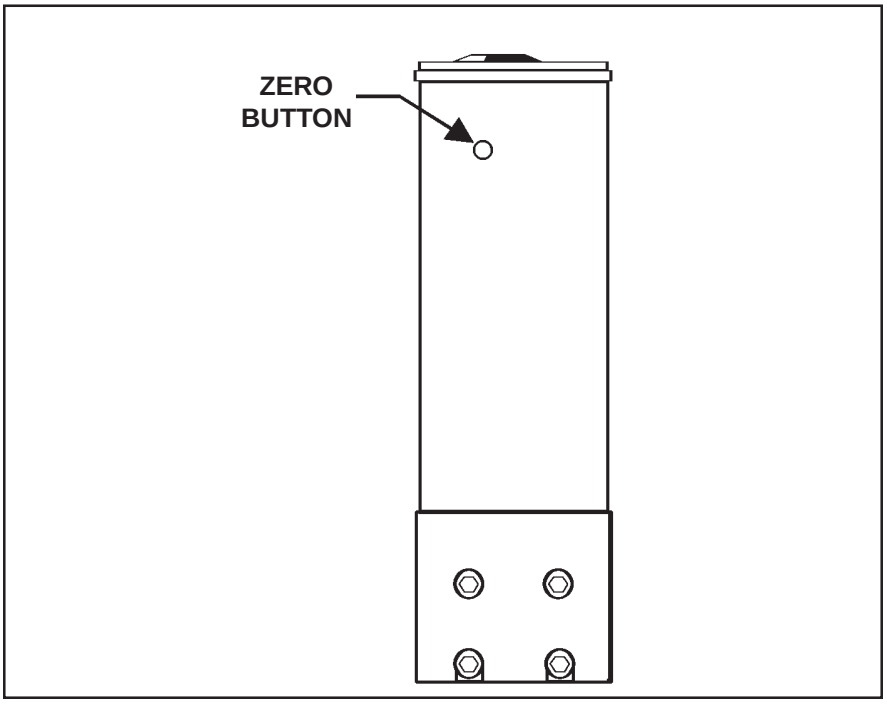


Figure 3-2 Externally Accessible Adjustment.

customer order Model SLA6900/SLA6800's containing a single calibration will have that calibration stored in calibration #1.

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3-4 Adaptive Valve Control (MFC only)

The SLA6950/SLA6850 Series offers a feature, called adaptive valve control, which allows the instrument to learn about the process gas and operating conditions. If multiple calibrations are being used, the adaptive valve control procedure must be performed separately for each calibration.
The adaptive valve control process requires that the process gas be supplied to the SLA6900/SLA6800 Series at the pressure and temperature which will exist during the process.

If the system conditions have changed so substantially that the Model 6950 becomes unstable, the adaptive valve control algorithm determines new gains which will stabilize the instrument and restore the step response to the factory performance level.

3-5 Analog Mode of Operation

A. Functional Description
The analog interface is consistent with other Brooks analog MFCs/MFMs. This includes a 0-5 volt setpoint input, 0-5 volt flow signal output, Valve Override input, and Calibration Select input pin. All analog signals available are on the 15 pin D-connector with each signal on the same pin as the Brooks Model 5964 MFC (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 SLA6950/SLA6850 Series ordered with only one calibration will have that calibration stored in calibration #1. Before operating the SLA6950/SLA6850 Series, apply power and warm-up the instrument for approximately one hour. After warm-up, apply gas pressure then proceed by following the instructions in the following sections.

B. Analog Setpoint (MFC Only)
This input allows the user to establish the MFC setpoint. The usable range of this input is from 0 to 5.5 Vdc which corresponds to 0 to 110% of the MFC full scale flow rate. The setpoint input is capable of responding to input changes of 0.5 mV or less. Setpoints below 45 mV will be treated as 0 volt setpoints. For setpoints below 0 Vdc the MFC 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 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 0 to 120% of the full scale flow rate. A negative flow signal indicates reverse flow through the device, but is NOT calibrated. The analog flow signal is capable of resolving signals to 0.5 mV.

D. Valve Override (MFC Only)
This input allows the valve to be forced to its most closed state or its most open state, regardless of setpoint. If this input is not electrically connected the MFC will operate according to the current values of the other MFC 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 held to +15 Vdc the valve will be forced to its most open state.

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E. Calibration Select Pin
Connector pin 13 on the 15 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 0.5 seconds.

NOTE: It is recommended to change calibrations during no-flow conditions.

Table 3-1 Typical Resistor Values for Calibration Select

DEFAULT = CAL # 1 (External resistor not installed)	
CAL #	**RESISTOR VALUE (kohms)**
1	Not Installed
2	0 or short
3	665
4	324
5	191
6	124
7	80.6
8	52.3
9	30.9
10	15

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 Fig. 3-2) to start the Self-zero function.

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

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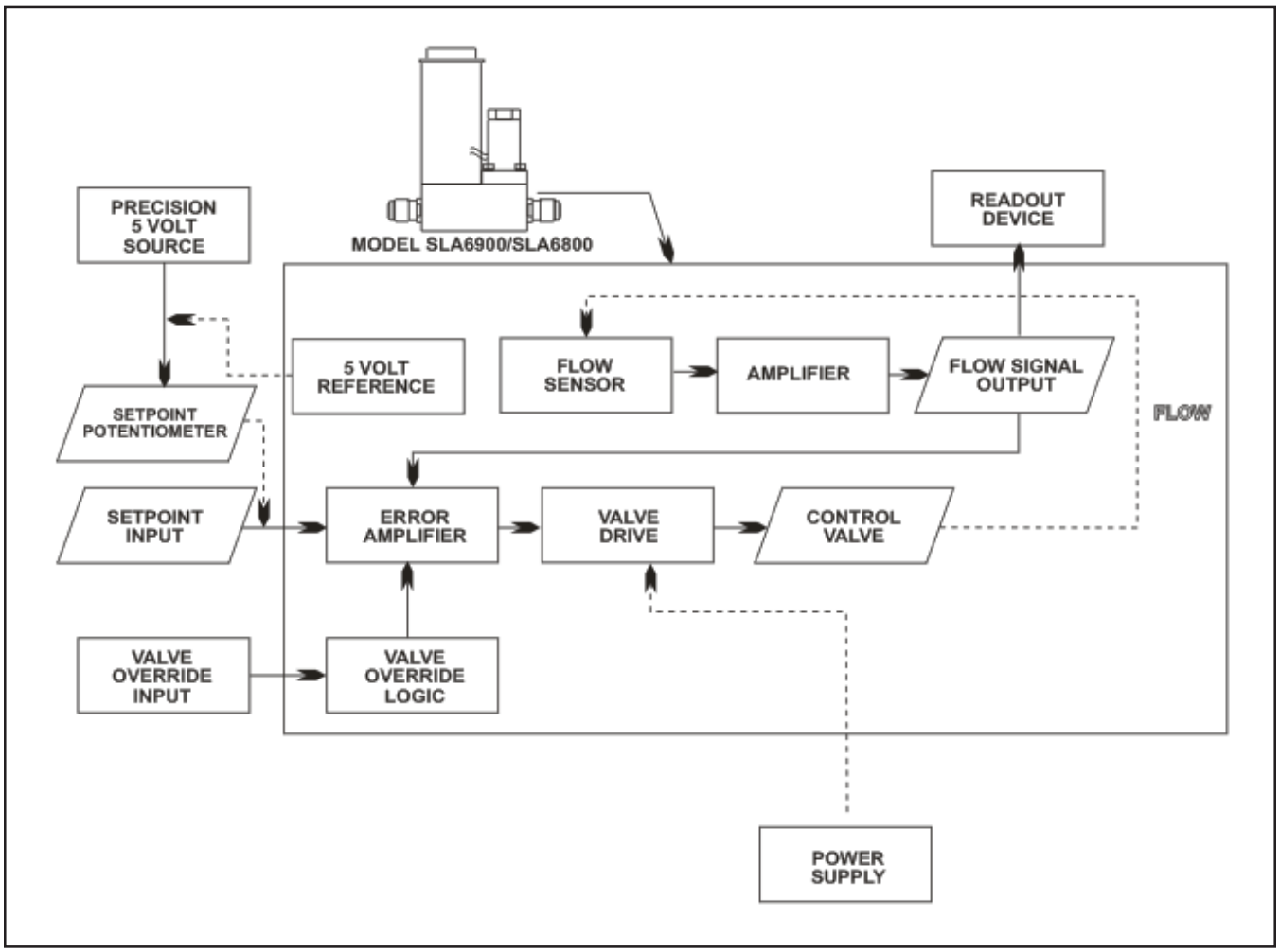


Figure 3-3 Flow Control System Block Diagram. (MFC only)

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4-1 Overview

No routine maintenance is required on the SLA6900/SLA6800 Series. If an in-line filter is used, the filtering elements should be periodically replaced. This section provides the following information:

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

***** indicates MFC only



⚠ 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.

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4-2 Troubleshooting

⚠ WARNING

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

⚠ WARNING

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

⚠ CAUTION

It is important that this MFC/MFM only be serviced by properly trained and qualified personnel.

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

Brooks PN# S273Z668AAA breakout kit can be used as an accessory for diagnosing electrical problems.

a. Problem: Flow/flow signal doesn't reach setpoint. (MFC Only)
Failure of the flow rate or flow signal to achieve the setpoint could be caused by a number of factors:

1. Insufficient pressure drop across the SLA6950/SLA6850 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 with that specified on the order. Increase the pressure if necessary.
2. Setpoint is below minimum. MFCs with metal seats may have a leak-through rate of up to 3% of full scale. These instruments are not guaranteed to operate below setpoints of 3.3% FS.

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3. 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.
4. 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.
5. 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.

b. ***Problem: Flow rate in excess of 100% at zero setpoint.***

1. Valve Override pin set to open.

c. ***Problem: Flow/flow signal 'unstable'.***

SLA6950/SLA6850 MFC performance is tuned during calibration at the conditions specified on the order. If the conditions in use (inlet and outlet pressure, temperature, attitude, gas or mixture type) are different or become different over time, the MFC may not perform as it did when it left the factory. There are numerous solutions to this situation:

1. Restore the conditions to the values as they appear on the order.
2. 'Adaptive valve control' the MFC. The MFC contains a function which allows it to learn about its environment. Adaptive valve control helps to match the valve performance to the gas, pressure, and temperature of actual use. Carefully read the section on adaptive valve control in Section 3-4.

d. Question: What is the purpose of the recessed push-button on the side of the MFC?

Answer: This push-button is used to start a Self-zero function, DO NOT press it unless you are performing this function as described in Section 3-5.

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

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Table 4-1 Bench Troubleshooting for MFC/MFM.

Trouble	Possible Cause	Check/Corrective Action
Output stays at zero level regardless of command and there is no flow through the controller.	Closed or clogged flow path up- or downstream or the controller.	Open valve(s). Clean filter(s). Remove any foreign material from gas delivery system.
	Clogged Control Valve.	Check TP3 with the command at 100%. If the voltage is more negative than -11V, disassemble and repair the control valve. Refer to Sections 4-3 and 4-4.
	-0 volts applied to the valve override input	Check valve override input. Refer to Section 2-10 for terminal assignments.
	Defective sensor.	Check sensor resistance. Refer to Table 4-2.
	Defective printed circuit board.	Replace printed circuit board.
	Clogged Sensor tube and restrictor and/or a clogged orifice.	Notify Factory Service Center.
Output signal stays at +6.8 Volts regardless of command and there is flow	+15 Volts applied to the valve override input.	Check the valve override terminal. Refer to Section 2-10 for terminal assignments. through the controller.
	Defective printed circuit board.	Replace printed circuit board.
	Setpoint input floating.	Connect command signal. Refer to Section 2-10 for terminal assignments.
	Valve stuck open or leaky.	Notify Factory Service Center.
Output signal follows set-point at higher commands but will not go to zero.	Leaky control valve	Notify Factory Service Center.
Output signal follows set-point at lower commands but does not reach full scale.	Insufficient inlet pressure or pressure drop.	Adjust pressures, inspect in-line filters and clear/replace as necessary.
	Wrong gas or conditions.	Check Factory Calibration Information.
	Partially clogged sensor	Notify Factory Service Center.
	Partially clogged valve.	Notify Factory Service Center.
Controller grossly out of calibration. Flow is higher than desired.	Partially clogged sensor.	Notify Factory Service Center.
Controller grossly out of calibration. Flow is lower than desired.	Partially clogged restrictor.	Notify Factory Service Center.
Controller oscillates.	Pressure drop or inlet pressure excessive.	Adjust pressures.
	Oversized orifice.	Check orifice size. Refer to Section 4-3.
	Wrong gas or conditions.	Check Factory Calibration Information.
	Faulty pressure regulator.	Check regulator output.
	Defective printed circuit board.	Replace printed circuit board.

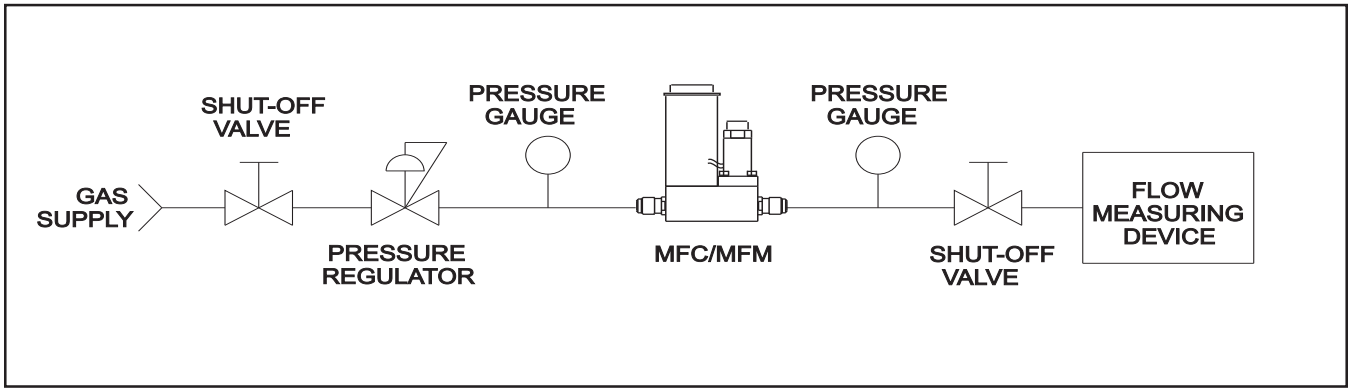


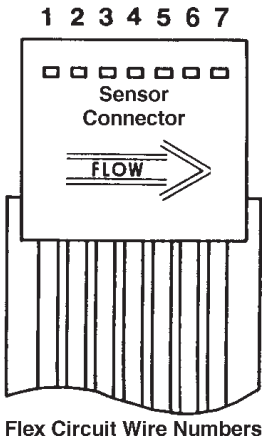
Figure 4-1 Bench Troubleshooting Circuit

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Table 4-2. Sensor Troubleshooting.

SENSOR SCHEMATIC

PIN NO.	FUNCTION
1	Heater
2	Upstream Temperature Sensor (Su)
3	Downstream Temperature Sensor (Sd)
4	Sensor Common
5	Heater Common



Remove the sensor connector from the PC Board for this procedure.

OHMMETER CONNECTION	RESULT IF ELECTRICALLY FUNCTIONAL
Pin 1 or 4 to meter body	Open circuit on ohmmeter. If either heater (1) or sensor common (4) are shorted, an ohmmeter reading will be obtained.
Pin 4 to Pin 2	Nominal 1100 ohms reading, depending on temperature and ohmmeter current.
Pin 4 to Pin 3	
Pin 5 to Pin 1	Nominal 1000 ohm reading.
Pin 6 to Pin 7	Nominal ohm reading.

⚠CAUTION

The sensor of the SLA6900/SLA6800 Series is not removable. Do not attempt to disassemble or remove the sensor from the body. Removing the two hold-down screws may cause irreparable damage to the sensor tube and leakage of the process gas.

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Table 4-3 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)

4-3 Gas Conversion Factors

If a mass flow controller is operated 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 4-4. To change to a new gas, multiply the output reading by the ratio of the gas factor for the desired gas by the gas 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 controller is calibrated for Nitrogen.

The desired gas is Carbon Dioxide (CO_2)

The output reading is 75 sccm when Carbon Dioxide is flowing

Then 75 x 0.773 = 57.98 sccm of (CO_2)

In order to calculate the conversion factor for a gas mixture, the following formula 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)

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P_n = percentage (%) of gas n (by volume)

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

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

Nitrogen equivalent flow = 20/.945 = 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 4-5 are calculated based on a gas temperature of 21°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. 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 Nitrogen equivalent flow rate (refer to Table 4-4).

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

OR

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

Where:

$Q_{NITROGEN}$ = Nitrogen equivalent flow rate (sccm)

Q_{GAS} = Desired flow rate of the gas (sccm)

$\rho_{NITROGEN}$ = Density of Nitrogen at 70°F

ρ_{GAS} = Density of the gas (taken at customer temperature)

SG_{GAS} = Specific gravity of the gas (taken at customer temperature)

Refer to Table 4-5 for densities.
Example:

Q_{gas} = 2,000 sccm

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

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

= 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 by volume of gas 1

P_2 = percentage by volume of gas 2

P_n = percentage by volume of gas n

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Example: Find the Nitrogen equivalent for 20 slpm of a 20% Helium and 80% Chlorine gas mixture.

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

$$Q_{Nitrogen} = Q_{gas}\,(\text{orifice conversion factor})$$

$$= 20 \times 1.439$$

$$= 28.78 \text{ slpm Nitrogen}$$

2. If inlet and outlet pressures 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.

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

   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 line 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).

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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

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 SLA6900/SLA6800 Series mass flow controller/meter uses two types of restrictor assemblies depending on full scale flowrate and expected service conditions.

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 (A.C.L.F.E.) - This type of restrictor assembly is used for Nitrogen equivalent flow rates less than 3.4 slpm.

Sizing
All SLA6900/SLA6800 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 SLA6900/SLA6800 Series mass flow controller/meter is shown in Table 4-4.

Example:
The desired gas is Silane (SiH_4).
The desired full scale flow rate is 200 sccm.
Sensor conversion factor is 0.625 from Table 4-4.
Nitrogen equivalent flow = 200/0.625 = 320 sccm Nitrogen

In the example above a Size P restrictor would be selected.

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Table 4-4 Conversion 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

Ref. No. J-836D508 gasdata.doc Vsn. 8.6

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Table 4-4 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

Ref. No. J-836D508 gasdata.doc Vsn. 8.6

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Table 4-4 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

Ref. No. J-836D508 gasdata.doc Vsn. 8.6

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

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

Nitrogen equivalent flow = 20/.945 = 21.16 slpm Nitrogen. In this example a Size 4 Wire Mesh Assembly would be selected.

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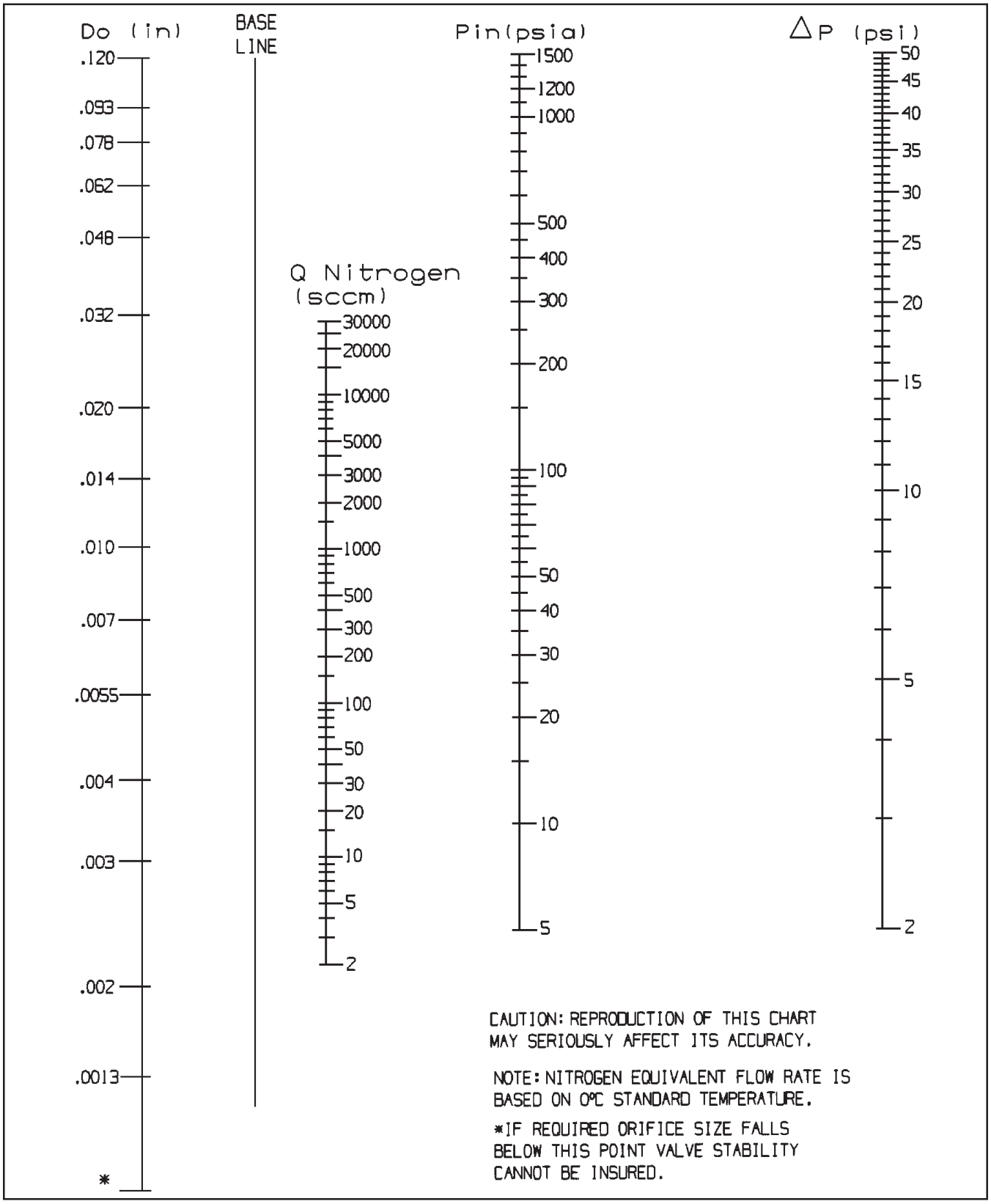


Figure 4-2 Model SLA6950 Series Orifice Sizing Nomograph.

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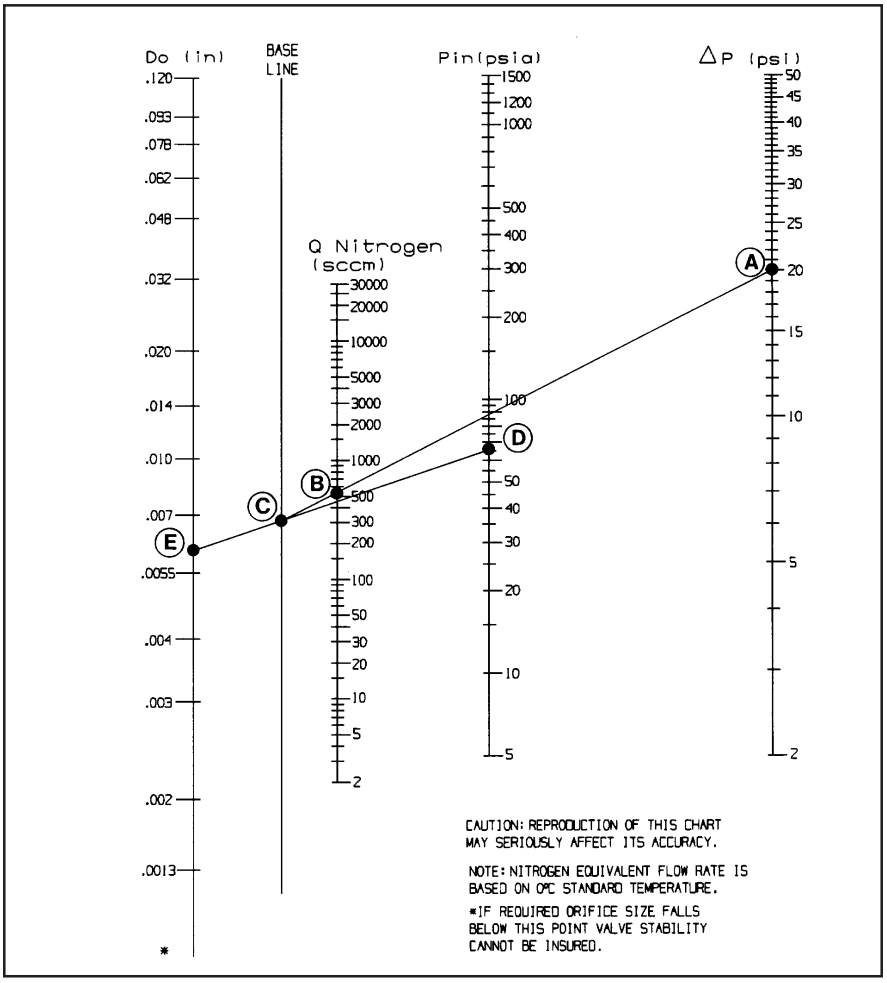


Figure 4-3 Example Nomograph.

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Table 4-5 Model SLA6900/SLA6800 Series Standard Restrictors.

Size	Range SCCM Nitrogen Equivalent Flow*		Part Number	
	Low	High	ACLFE	Wire Mesh
D	8.038	11.38	S110Z275BMG	
E	11.25	15.93	S110Z276BMG	
F	15.75	22.30	S110Z277BMG	
G	22.05	31.23	S110Z278BMG	
H	30.88	43.73	S110Z279BMG	
J	43.23	61.21	S110Z280BMG	
K	60.52	85.70	S110Z281BMG	
L	84.73	119.9	S110Z282BMG	
M	118.6	167.9	S110Z283BMG	
N	166.0	235.2	S110Z284BMG	
P	232.5	329.3	S110Z285BMG	
Q	325.4	460.9	S110Z286BMG	
R	455.7	645.3	S110Z287BMG	
S	638.0	903.4	S110Z288BMG	
T	893.2	1265.	S110Z289BMG	
U	1250.	1771.	S110Z290BMG	
V	1750.	2479.	S110Z291BMG	
W	2451.	3471.	S110Z292BMG	
X	3431.	4859.		S110Z319BMG
Y	4804.	6802.		S110Z321BMG
1	6724.	9523.		S110Z317BMG
2	9388.	13337.		S110Z228BMG
3	13176.	18667.		S110Z226BMG
4	18457.	30060.		S110Z224BMG

*Materials: BMG = 316 Stainless Steel Electropolished

NOTES:• For flow rates less than 8 sccm, use the low flow plug, P/N 618K019BMG in place of a restrictor assembly.
• If two sizes are allowed because of overlap, select the larger size.
• Restrictor size not required to enter order.

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CE Certification of Mass Flow Equipment

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.

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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.

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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
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.

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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,

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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

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Brooks Instrument
407 West Vine St.
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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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