# Installation and Operation Manual

# PC100 Series
# Pressure Controllers

BROOKS® INSTRUMENT

*Beyond Measure*

# Essential Instructions
## Read before proceeding!

Brooks Instrument designs, manufactures and tests its products to meet many national and international standards. These products must be properly installed, operated and maintained 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, operating and maintaining Brooks Instrument products.

- To ensure proper performance, use qualified personnel to install, operate, update, program and maintain the product.
- 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.

⚠ **WARNING: Do not operate this instrument in excess of the specifications listed in the Instruction and Operation Manual. Failure to heed this warning can result in serious personal injury and / or damage to the equipment.**

- 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.

⚠ **WARNING: Prior to installation ensure this instrument has the required approval ratings to meet local and national codes. Failure to heed this warning can result in serious personal injury and / or damage to the equipment.**

- 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.
- Operation: (1) Slowly initiate flow into the system. Open process valves slowly to avoid flow surges. (2) Check for leaks around the flow meter inlet and outlet connections. If no leaks are present, bring the system up to the operating pressure.
- Please make sure that the process line pressure is removed prior to service. 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 to prevent electrical shock and personal injury, except when maintenance is being performed by qualified persons.

⚠ **WARNING: For liquid flow devices, if the inlet and outlet valves adjacent to the devices are to be closed for any reason, the devices must be completely drained. Failure to do so may result in thermal expansion of the liquid that can rupture the device and may cause personal injury.**

## European 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 Specifications Section of this manual contains instructions related to the PED directive.
- Products described in this manual are in compliance with EN directive 97/23/EC.
- All Brooks Instrument Flowmeters fall under fluid group 1.
- Products larger than 25mm or 1" (inch) are in compliance with PED category I, II or III.
- Products of 25mm or 1" (inch) or smaller are Sound Engineering Practice (SEP).

## European Pressure Equipment Directive (PED)

The Brooks Instrument (electric/electronic) equipment bearing the CE mark has been successfully tested to the regulations of the Electro Magnetic Compatibility (EMC directive 2004/108/EC).
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 Instrument 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 an 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 an earth ground.
For pin configuration: Please refer to the enclosed Instruction Manual.

## 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 internal 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.

**Section 1 Introduction**



**Section 2 Installation**



**Section 3 Operation**



**Section 4 Maintenance & Troubleshooting**



**Section 5 Product Description Code**

**Tables**



**Figures**

## Introduction

Brooks Instrument's PC100 Series pressure control and flow measurement devices deliver outstanding performance, reliability, and system simplicity. Built on the proven, advanced technology of the GF100 Series mass flow controllers, process throughput and yield are maximized while process costs are reduced. The PC100 Series is designed for semiconductor, MOCVD, and other pressure control applications that require a high purity all-metal flow path.

- PC115 Pressure Controller and PC125 Pressure Controller with integrated thermal mass flow metering. Initial product offering includes $N_2$, $H_2$, He and Ar gases with full scale 1000 Torr pressure operations.
- An independent diagnostic/service port to tune the pressure controller without removing the unit
- Long-term stability due to extremely low wetted surface area, and corrosion resistant Hastelloy® sensor and valve seat


*Figure 1-1 PC100 Series Digital Pressure Controller*

## How to Use This Manual

This manual is intended to provide the user with all the information necessary to install, operate, troubleshoot and maintain these pressure control devices. The manual is organized in the following sections:

Section 1 General Information

Section 2 Installation

Section 3 Operation

Section 4 Maintenance and Troubleshooting

Section 5 Product Description Code

Appendix A Essential Instructions

Warranty, Local Sales/Service Contact Information

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

### Product Support References

Refer to www.BrooksInstrument.com for Brooks sales and service locations and to obtain other documents that support the PC100 Series. Those documents include:

- Brooks DeviceNet Supplemental manual for PC100 Series: X-DPT-DeviceNet-PC100-PC-eng
- Brooks Analog/RS485 Supplemental manual for PC100 Series 541B238AAG
- Brooks PC100 Series Data Sheet: DS-PR-PC100-Series-PC-eng

### Notice and Caution Statements

Warning, caution and notice statements are located throughout this manual in the ANSI format. A WARNING statement indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury. A CAUTION statement indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury. It may also be used to alert against unsafe practices. A NOTICE statement describes specific information that requires special attention.

### Product Warranty

Product warranty information can be found on the Back Cover of this Manual and on the Brooks website at www.BrooksInstrument.com. This information provides general warranty information, limitations, disclaimers, and applicable warranty periods according to product group.

### How to Order a PC100 Series Device

Refer to Section 5.

### Industry Standard References

Refer to Table 1-1.

### Glossary of Terms and Acronyms

Refer to Table 1-2

*Table 1-1 Industry Standard References*

| Reference Number | Reference Description |
|---|---|
| MIL-STD-810 | Method 514.4, Category 1, Transportation Requirement<br>Method 516.4, Procedure 1, Functional Shock Test Requirement |
| SEMI E12 | Standard temperature and pressure |
| SEMI E16 | Guideline for determining and describing MFC leak rates |
| SEMI E17 | Guideline for MFC transient characteristics tests |
| SEMI E18 | Guideline for temperature specifications of the MFC |
| SEMI E27 | Standard for MFC and MFM linearity |
| SEMI E28 | Guideline for pressure specifications for the MFC |
| SEMI E52 | Practice for referencing gases used in digital MFCs |
| SEMI E54 | Sensor actuator network connections for DeviceNet |
| SEMI E56 | Test method for determining accuracy, linearity, repeatability, short-term reproducibility, hysteresis of thermal MFCs |
| SEMI E66 | Test method for determining particle contribution by MFCs |
| SEMI E67 | Test method for determining reliability of MFCs |
| SEMI E68 | Test method for determining warm-up time of MFCs |
| SEMI E69 | Test method for reproducibility and zero drift for thermal MFCs |
| SEMI E80 | Test method for determining attitude sensitivity of MFCs |
| SEMI E16-90 | Guidelines for determining and describing mass flow controllers leak rates |
| SEMI F19 | Specification for the finish of the wetted surface of electro polished 216L stainless steel components |
| SEMI F20 | Specifications for 316L stainless steel bar, extruded shapes, plate, and investment castings for components used in ultra-high purity semi manufacturing applications |
| SEMI F36 | Guide for dimensions and connections of gas distribution components |
| SEMI F37 | Method for determination of surface roughness parameters for gas distribution system components |
| SEMI F44 | Guideline for standardization of machined stainless steel weld fittings |
| SEMI F45 | Guideline for standardization of machined stainless steel reducing fittings |
| SEMI F47 | Specifications for semiconductor processing equipment voltage sag immunity |
| SEMI S2 | Environmental, Health and Safety Guidelines |
| SEMI S9 | Dielectric testing |
| SEMI S10 | Risk assessment |
| SEMI S12 | Decontamination of fielded products |

*Table 1-2 Terms and Acronym*

| Term or Acronym | Definition |
|---|---|
| CSR | Customer Special Requirement |
| CVD | Chemical Vapor Deposition |
| DeviceNet | A 5-wire local network I/O communication device that employs a command/response communication protocol |
| DSP | Digital Signal Processor |
| EPI Epitaxy (EPI) | A process technology where a pure silicon crystalline structure is deposited or “grown” on a bare wafer, enabling a high-purity starting point for building the semiconductor device. |
| F.S. | Full Scale |
| LED | Light Emitting Diode |
| MFC | Mass Flow Controller |
| PC | Pressure Controller |
| PSIA | Pounds per Square Inch Absolute |
| PSID | Pounds per Square Inch Differential |
| PSIG | Pounds per Square Inch Gauge |
| HC | Standard Configuration w/ Hastelloy® sensors (to reduce reaction to corrosive gases) |
| S.P. | Setpoint |
| Step Technology | Enables fast set point control through a high speed DSP and low volume drive circuit |
| VIU | Vertical mounting attitude with inlet side facing up |

## Description

The Brooks PC100 Series digital pressure control with patented flow sensor combined with a high speed ARM processor and fast acting diaphragm-free valve assembly enables:

- Faster response and settling time for improved pressure control
- Reduced diverted gas consumption and associated abatement costs
- User programmable start-up function for processes requiring a slow ramped pressure control

### Accessories:

| | |
|---|---|
| A331710003 | Cable Assembly 2.5 mm |
| 214F027AAA | USB-RS485 Converter with DB-9 Female |
| A332295001 | Power Supply PC |
| A332297001 | Cable, Power, DeviceNet |

### PC125 Only - Advanced Thermal Flow Measurement Sensor

Brooks proprietary highly corrosion resistant Hastelloy C-22 sensor with an enhanced sensor manufacturing and burn in process incorporates a unique orthogonal sensor mounting orientation to eliminate sensor drift caused by valve heating effects and eliminates thermal siphoning effects. This unique sensor configuration includes an optimized temperature profile for gases prone to thermal decomposition. This design results in:

- Enhanced signal to noise performance for improved accuracy at low set points
- Superior reproducibility at elevated temperature through new isothermal packaging and onboard conditioning electronics with ambient temperature sensing and compensation
- Improved long-term stability

### High Purity Flow Path

The Brooks PC100 Series has an all metal, corrosion resistant Semi F20 compliant wetted flow path with highly corrosion resistant Hastelloy C-22 valve seat and jet orifice.

- Overall reduced surface area and un-swept volumes for faster dry-down during purge steps
- Long-term sensor and device stability for maximum yield and throughput

### Mechanical Configurations

- 1-1/8” body width, 1/4” VCR male
- 1-1/8” body width, 92 mm C Seal
- 1-1/8” body width, 92 mm W Seal
- 1-1/8” body width, 92 mm C Seal w/ Poke Yoke

### Enhanced Diagnostics and User Interface

The Brooks PC100 Series devices provide for in-line device evaluation and instantaneous troubleshooting through:

- Independent diagnostic/service port
- High visibility LCD display with easy accessible push button for local indication of Flow (%), Temperature (°C), Pressure (PSIA/kPa/Torr) and Network Address
- Zero button to easily re-zero the device during scheduled maintenance. Zero button will zero pressure transducer of thermal sensor depending on what is visible on the display. This combination of features results in limited service interruption and reduced downtime.

### Communication Interfaces

The PC100 Series supports analog 0-5 Vdc, RS485 and DeviceNet™ communication protocol. Analog communications can be accessed via the DeviceNet or RS485 or Analog only connector options. DeviceNet and RS485 are multi-drop connections that allow a maximum of 64 devices for DeviceNet and 32 devices for RS485 to be connected on the same network. Brooks Instrument's DeviceNet profile has been certified by the ODVA™ (Open DeviceNet Vendor's Association). A range of low profile adapter cables facilitate replacing previously installed devices eliminating the need to carry multiple devices of the same gas/range but different electrical connectors.

## Specifications for PC100 Series Devices

**⚠ 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.**

**⚠ 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.**

See Table 1-3 for specifications for the PC100 Series.

See Figure 1-3 for dimensions for the PC100 Series

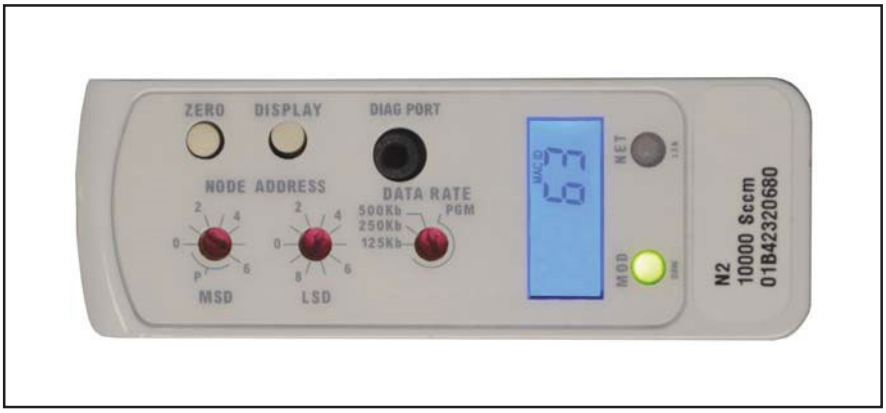



*Figure 1-2 LCD Display*

*Table 1-3 Specifications - PC100 Series*

| | PC115XD | PC125XD | PC115XU |
|---|---|---|---|
| **Performance** | | | |
| **Pressure Control Mode** | Downstream | | Upstream |
| **Embedded Thermal Flow Sensor** | Not Applicable | Ability to Monitor Flow | Not Applicable |
| **Full Scale Range** | 3-10000 sccm $N_2$ Eq. | 2600-10000 sccm $N_2$ Eq. | 3-5000 sccm $N_2$ Eq. |
| **Pressure Reading** | | | |
| **Reference** | 34 to 100 psia | | 0 to 35 Torr |
| **Accuracy** | ±1% of reading | | |
| **Zero Temperature Coefficient** | ±0.02% of F.S./°C | | |
| **Span Temperature Coefficient** | ±0.04% of reading/°C | | |
| **Pressure Control** | | | |
| **Measurement Range** | 2-100% F.S. | | |
| **Accuracy** | <10% F.S. ±0.2% F.S., 10-100% F.S. ±1% F.S. | | |
| **Response Time** | <1 sec typ. (excluding system time constant) | | |
| **Flow Reading** | | | |
| **Measurement Range** | --- | 2-100% of F.S. | --- |
| **Accuracy** | --- | >35% ±1% of reading<br>2-35% ±0.35% F.S. | --- |
| **Repeatability** | --- | ±0.2% of F.S. | --- |
| **Zero Temp. Coefficient** | --- | <0.05% of F.S./°C | --- |
| **Span Temp. Coefficient** | --- | <0.08% of reading/°C | --- |
| **Zero Stability** | --- | <0.5% per year | --- |
| **Valve Leak-by** | <1% of F.S. | | |
| **Ratings** | | | |
| **Operating Temperature Range** | 10 to 50°C | | |
| **Transducer Pressure Range** | 1000 Torr | | |
| **Transducer Over Pressure Limit** | 2000 Torr | | |
| **Differential Pressure** | 45 psid max | | 150 Torr min |
| **Leak Integrity (external)** | 1 x $10^{-10}$ atm. cc/sec He | | |
| **Electrical** | | | |
| **Electical Connection** | RS485/Analog via 9-Pin "D" connector, DeviceNet™ via 5-pin "M12" connector | 5-pin M12 Connector | RS485/Analog via 9-Pin "D" connector, DeviceNet™ via 5-pin "M12" connector |
| **Digital Communications** | RS485 (model specific),<br>DeviceNet (model specific) | DeviceNet (model specific) | RS485 (model specific),<br>DeviceNet (model specific) |
| **Diagnostic/Service Port** | RS485 via 2.5 mm jack | | |
| **Power Supply/Consumption** | DeviceNet: 545mA max. @ +11-25 Vdc, 250 mA max. @ 24 Vdc<br>RS485/Analog: 6 Watts max @ ±15 Vdc. (±10%) or +24 Vdc (±10%) | DeviceNet: 545mA max. @ +11-25 Vdc, 250 mA max. @ 24 Vdc | DeviceNet: 545mA max. @ +11-25 Vdc, 250 mA max. @ 24 Vdc<br>RS485/Analog: 6 Watts max @ ±15 Vdc. (±10%) or +24 Vdc (±10%) |
| **Diagnostics & Display** | | | |
| **Status Light** | MFC Health, Network Status | | |
| **Display Type** | Top Mount Rotatable Integrated LCD (model specific) | | |
| **Viewing Distance Fixed** | 10 ft. | | |
| **Units Displayed** | Resolution Flow (%), Temp. (°C), Pressure (Torr, psia, kPa)/0.1 (unit) | | |
| **Mechanical** | | | |
| **Valve Type** | Normally Closed | | |
| **Wetted Materials** | SEMI F20 HP Compliant, 316L VIM/VAR, 304 Stainless Steel, Hastelloy C-22 | | |
| **Surface Finish** | 5µ inch Ra (0.1 µm Ra) | | |
| **Compliance** | | | |
| **EMC** | Analog/RS485/DNET: EC Directive 2004/108/EC CE: EN61326: 2006 (Fcc Part 15 & Canada IC-subset of CE testing)<br>EtherCAT: EMC Directive 2014/30/EU Evaluation Standard EN61326-1:2013 | | |
| **Environmental Compliance** | RoHS Directive (2011/65/EU & 2015/863/EU)<br>REACH Directive EC 1907/2006 | | |

PC100 Series - VCR® Configuration

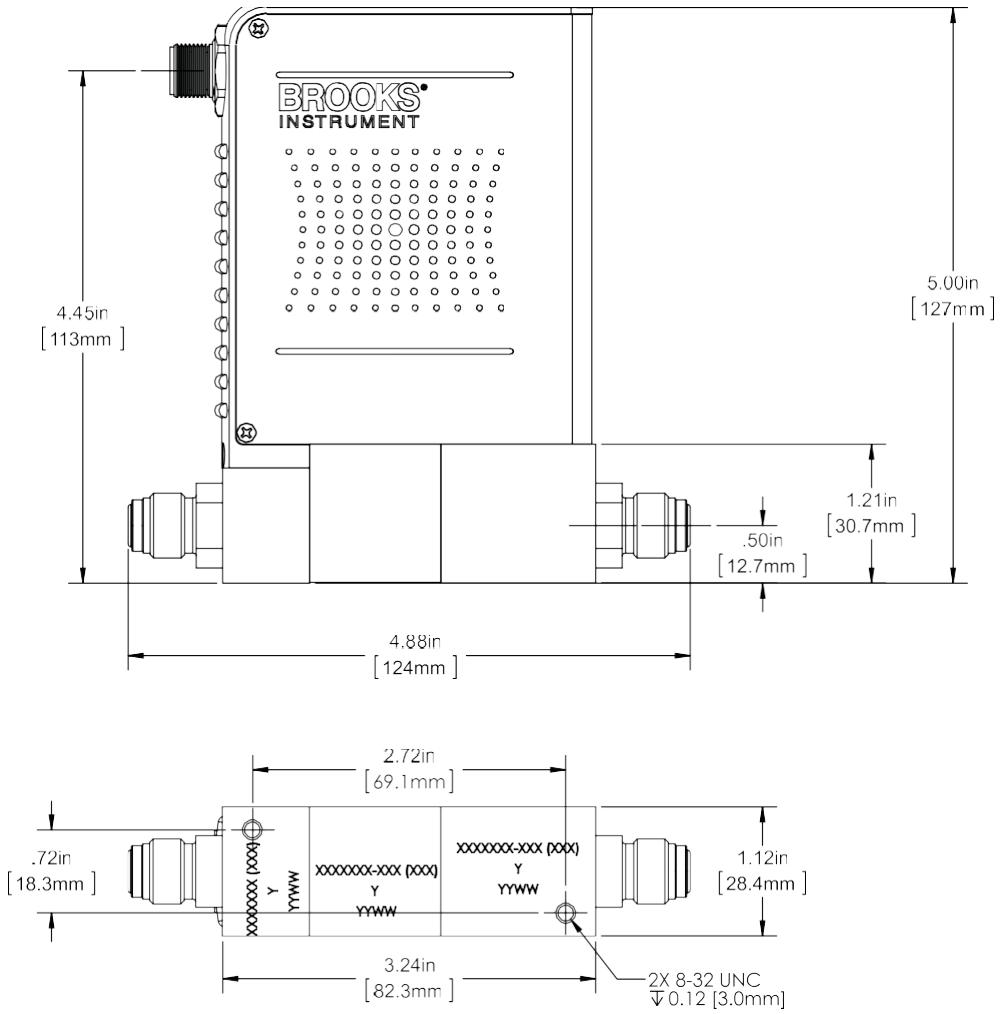



*Figure 1-3 Dimensions - PC100 Series*

## General

This section provides installation instructions for the Brooks PC100 Series Pressure Control Devices. The installation process consists of purging the gas supply line prior to installation, unpacking and inspecting the device, connecting the device to the gas supply line and testing for leaks.

## 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 be notified at once regarding his liability. A report should be submitted to the nearest Brooks Instrument location listed on the Global Service Network page on our website: BrooksInstrument.com/GlobalSupportCenters

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

This device has been assembled, calibrated, and double-vacuum bagged in a Class 100 clean room. In your semi-clean area, remove the outer bag only. Pass the device into your clean area. Remove the second clean room compatible bag only when the device is ready to be tested and/or installed in your clean system.

## Recommended Storage Practice

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

- Within the original shipping container.
- Ambient temperature 21°C (70°F) nominal, 32°C (90°F) maximum, 7°C (45°F) minimum.
- Relative humidity 45% nominal, 60% maximum, 25% minimum.

## Return Shipment

Prior to returning any instrument to the factory for any reason, visit our website for instructions on how to obtain a Return Materials Authorization Number (RMA #) and complete a Decontamination Statement to accompany it: BrooksInstrument.com/Service. All instruments returned to Brooks also require a Material Safety Data Sheet (MSDS) for the fluid(s) used in the instrument. Failure to provide this information will delay processing of the instrument.

Instrument must have been purged in accordance with the following:

**⚠WARNING**

**Before returning the device, purge thoroughly with a dry inert gas such as Nitrogen before disconnecting process connections. Failure to correctly purge the instrument could result in fire, explosion or death. Corrosion or contamination may occur upon exposure to air.**

### Transit Precautions

To safeguard against damage during transit, transport the device to the installation site in the same container used for transportation from the factory, if circumstances permit.

### Removal from Storage

Upon removal of the device from storage, a visual inspection should be conducted to verify its “as-received” condition. If the device has been subject to storage conditions in excess of those recommended (refer to “Recommended Storage Practice” on p. 13), it should be subjected to a pneumatic pressure test in accordance with applicable vessel codes. To maintain a devices ultra-clean integrity, this service should be performed by the factory or one of the certified service centers.

### Gas Connections

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

### In-Line Filter

It is recommended that an in-line filter be installed upstream from the device 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.

### Mechanical Installation

**⚠CAUTION**

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

The recommended installation procedure guidelines are as follows:

- The device should be located in a clean, dry atmosphere relatively free from shock and vibration.
- Leave sufficient room for access to the user interface, display and MAC ID and baud rate switches (if equipped) at the top of the device.
- Install the device in such a manner that permits easy purge and removal if the device 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.**

### Flow Controller Installation Arrangement

Typical configurations are shown below in Figure 2-1.

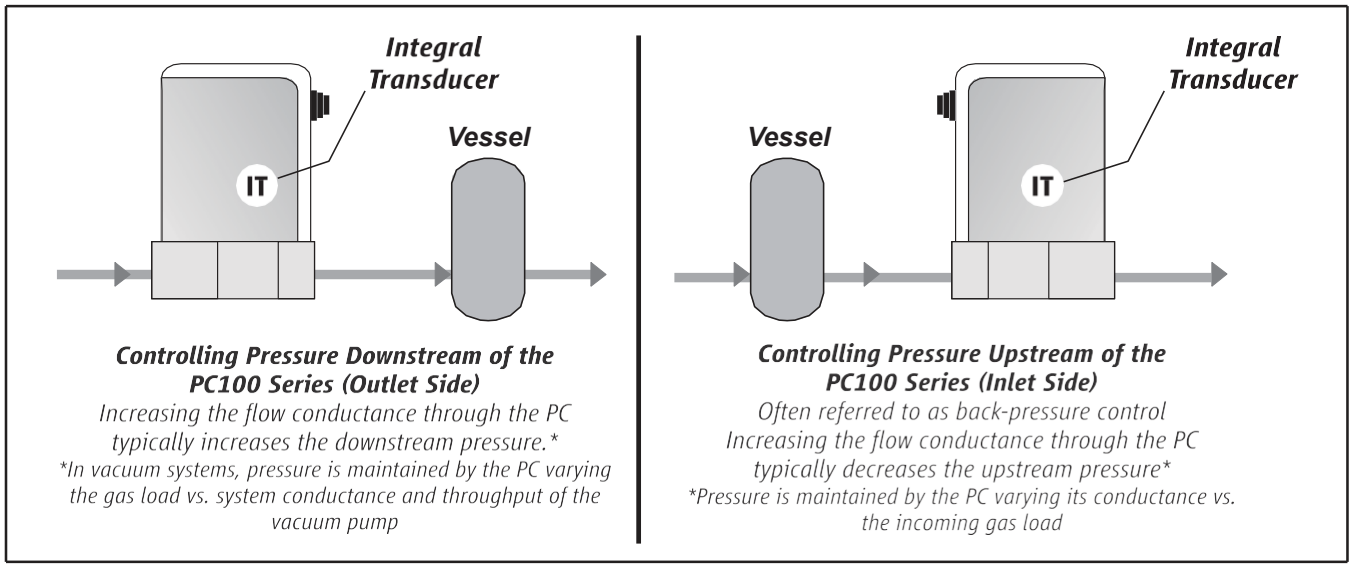



*Figure 2-1 Typical PC100 Series Configurations*

**Purge the Gas Supply Line Before PC100 Series Installation**

**⚠ NOTICE**

**It is recommended to archive service and calibration documentation for the PC100 Series in order to determine the contamination state of each gas line and to assist service personnel.**

**⚠ CAUTION**

**DO NOT remove the shipping caps covering the inlet/outlet for VCR fittings, or DO NOT remove the blue tape on the bottom of the device for downported fittings before the PC100 Series is actually being installed. Failure to comply will introduce contaminants into the PC100 Series.**

Before operating the PC100 Series, the gas supply line must be completely purged with nitrogen or argon to ensure the line is free from toxic or flammable gases, contaminants, moisture, and oxygen. The purge gas must be free of moisture and oxygen to less than 100 ppb. Purge the gas lines as follows or in accordance to prescribed company and safety procedures.

1. Shut off the process gas supply valve(s) upstream of the PC100 Series. If such a valve is not available, shut the valve on the gas panel. Tag the valve at this point to prevent accidental re-exposure of the process gas to the gas line.

2. Cycle purge the gas line with dry nitrogen or argon to fully flush out the process gas. Cycle purging consists of evacuating to a low pressure adequate to induce out-gassing and then purging to remove adhered moisture and oxygen. If a toxic or reactive gas is present and a clogged PC100 Series is suspected, then proceed with caution. Pump down and purge the PC100 Series from both downstream and upstream lines. If check valves are present in the gas line, both pumping down and purging are required. Pumping down without purging is inadequate. If a good vacuum source is not available, the PC100 Series can be de-contaminated by purge only.

3. Repeat the purge cycle several times within 2-4 hours to complete the cleaning. For toxic and corrosive gases, it is recommended to use 100-120 cycles.

### Position and Mount the PC100 Series

Position the PC100 Series so that the gas flow is pointed in the direction of the flow arrow on the PC100 Series rear S/N label. The various mounting positions for UPSTREAM applications are described in Figure 2-2, and the mounting positions for DOWNSTREAM applications are described in Figure 2-3.

The standard orientation for the PC100 Series is Horizontal Base Down (HBD).

The PC100 Series is configured with ¼" VCR fittings, secure the PC100 Series block to the gas panel with two, 8-32-UNC-2B" screws. Then connect the inlet/outlet fittings to the gas supply line using two wrenches. Tighten the fittings to manufacturer recommendations.

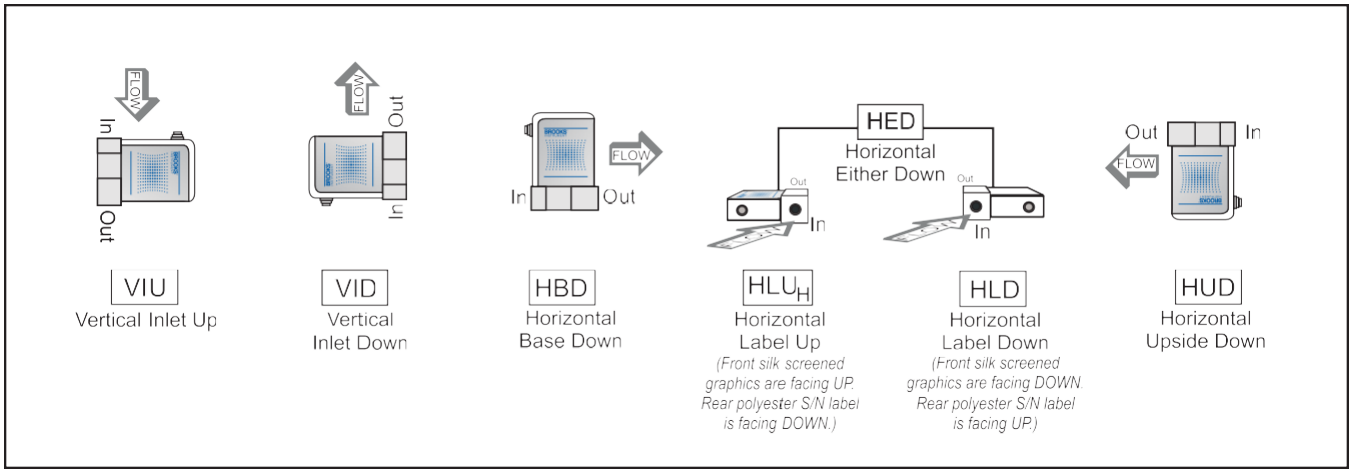



*Figure 2-2 PC100 Series Mounting Attitude Positions for UPSTREAM Applications*

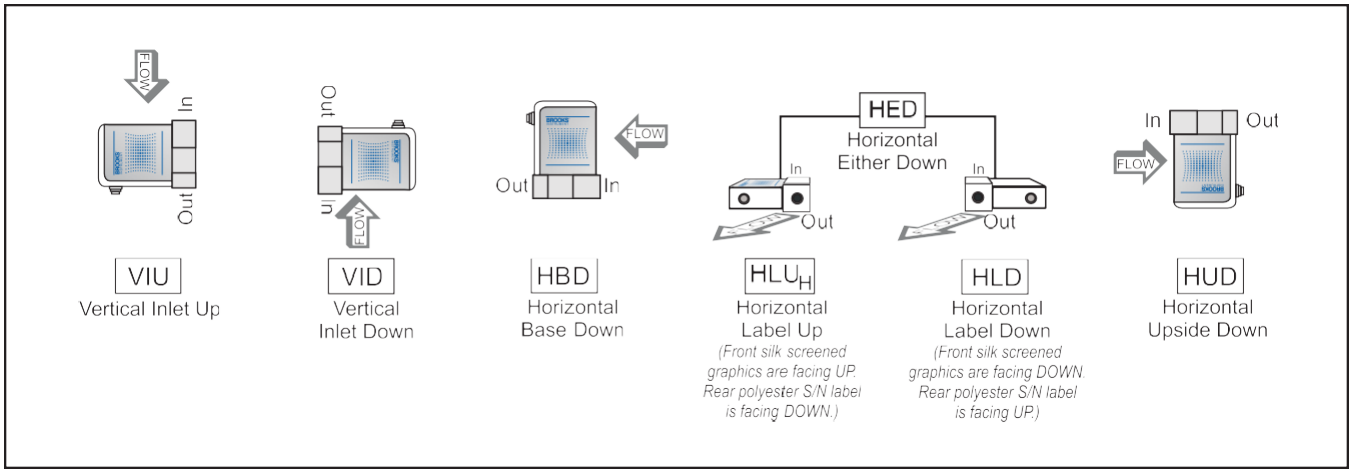



*Figure 2-3 PC100 Series Mounting Attitude Positions for DOWNSTREAM Applications*

### Perform a Leak Test

**⚠WARNING**

**Before operating the device, ensure all gas connections have been properly tightened and, where applicable, all electrical connections have been properly terminated.**

It is critical to leak test the gas supply lines and PC100 Series connections before turning on the process gas supply after any new installation. Check for leaks using a helium leak detector or any other appropriate leak test method. Follow leak test specifications as defined by integrator.

### Zeroing the PC100 Series - Setup

The PC100 Series pressure transducer and flow meter zeroing process is performed from the backlight LCD display on top of the PC100 Series.

OEM tools using a microprocessor or computer for operating the PC100 Series should sequence the PC100 Series off between processes. To accomplish this, simply provide a zero set point. The PC100 Series will shut off automatically.

Shut-off valves, whether upstream or downstream from the PC100 Series, should be programmed to turn on before the PC100 Series is turned on and turned off after the PC100 Series is turned off.

The following steps are required before the PC100 Series is zeroed.

1. Make sure that the PC100 Series has been installed inside the equipment (panel) for at least four hours and powered up at least one hour prior to zeroing. This insures that the PC100 Series is in its “use attitude” and is operating at normal temperature. If the PC100 Series is subjected to a vacuum purge for more than one minute, turn off the PC100 Series (ie., provide a zero setpoint) for a time period of twice the vacuum purge time.
2. Read the output signal of the PC100 Series. This output signal is the initial flow in percent of full scale. The output signal should be 0.0 (± 0.1%). If the output signal is too high, re-zero the PC100 Series as described below.

### Zeroing the PC100 Series Pressure Transducer from the LCD Display Panel (PC115 & PC125)

1. Place the PC100 Series under a strong vacuum with the PC100 Series set to 100% set point. Make sure that upstream valve is closed and the downstream valve is open. Allow time for the upstream pressure to bleed off.

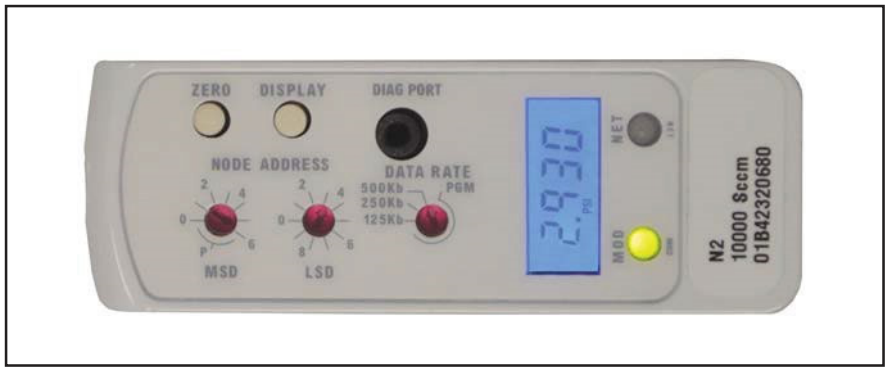



*Figure 2-4 Display with PSI Reading*

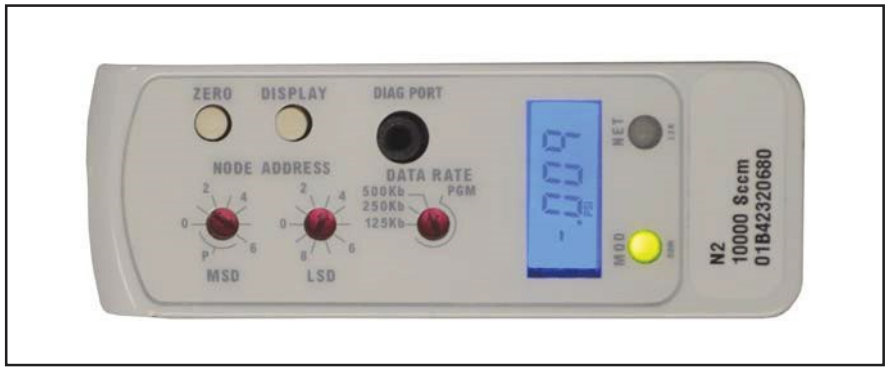



*Figure 2-5 Display Reading Zero PSI*

2. Looking at the top of the PC100 Series, press the “Display” button, starting at the MACID, four times to “PSI”, five times to “kPa” or six times to “Torr” until the LCD displays the labels “PSI”, “kPa” or “Torr”. The PC100 Series will display pressure in units of PSIA, kPa or Torr. Press and hold down the Zero button a minimum of 5 seconds or until the display reads 0.000, with the last two digits flickering at different values. The pressure transducer zeroing procedure can be done while the display is either in PSIA, kPA or Torr output. Refer to Figure 2-4.

After completion of the pressure transducer zeroing, the LCD display will read 0.0 with the last two digits flickering as shown in Figure 2-5.

### Zeroing PC125 Series Flow from LCD Display Panel

1. Place the PC125 Series under normal inlet operating pressure. Close the downstream valve to prevent any flow.
2. Looking at the top of the PC125 Series, press the “Display” button until the LCD display label is “%FS” as shown in Figure 2-6. Three button depressions from the MACID label display.
3. Press and hold down the Zero button for a minimum of 5 seconds or until the “%FS” display reads 0.0 as shown in Figure 2-7. The %FS label will flash during this procedure.

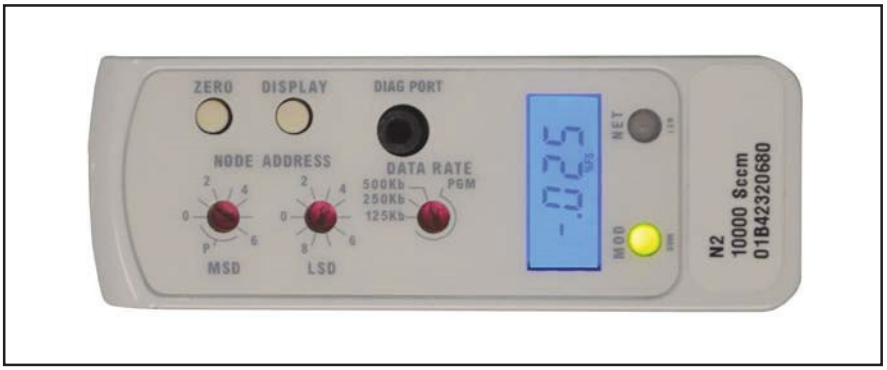



*Figure 2-6 Display Set to %FS*

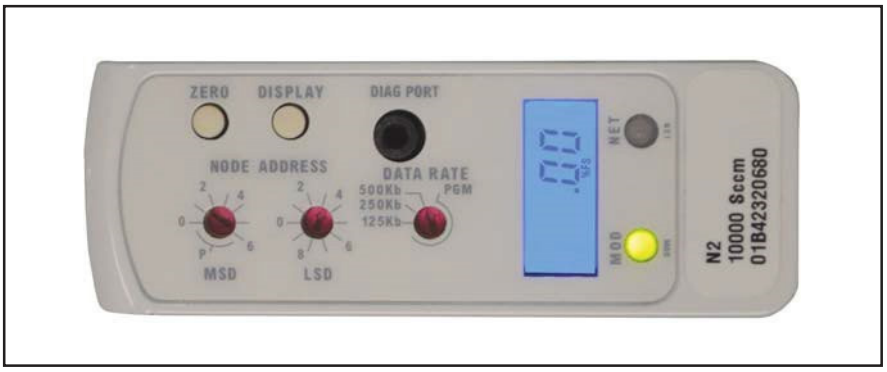



*Figure 2-7 % Flow Display Set to Zero*

**Performance Checks**

This Section describes how to zero and sequence the PC100 Series devices for proper operation.

**⚠ NOTICE**

**If the PC100 Series has been in the purge mode for a long period of time, wait until the PC100 Series has cooled down before zeroing. The cool down period should be ~30 minutes for purges up to five minutes and at least 60 minutes after purging overnight.**

- The PC100 Series must be warmed up for at least 30 minutes.
- The active gas page must be correct.
- The PC100 Series pressure transducer must be correctly zeroed.
- The PC125 Series flow must be correctly zeroed.

A331710003 Cable Assembly 2.5mm
A332295001 Power Supply MFC
A332297001 Cable, Power, DeviceNet

**⚠ CAUTION**

**DO NOT make any connections to unlabeled connector pins. Any failure to comply could damage the PC100 Series and/or the mating electrical device. Before connecting the cable, make sure that all pin connections of the mating cable have the same pin out connections. When installing and removing cables to and from your computer, make sure the power is turned off on your computer. This will prevent damage to your computer and associated equipment.**

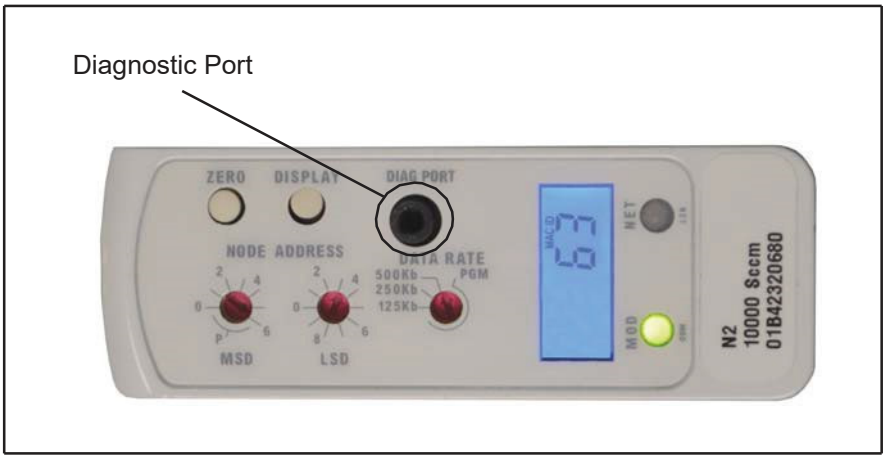



*Figure 2-8 Diagnostic Port*

## Electrical Connections

### DeviceNet Connections

DeviceNet is a 5 wire local network connection that employs a command response communication protocol for communicating between a master and slave. Obtain a DeviceNet communication cable (Micro M-12) and fasten it to the 5-pin connector as shown in Figure 2-9.

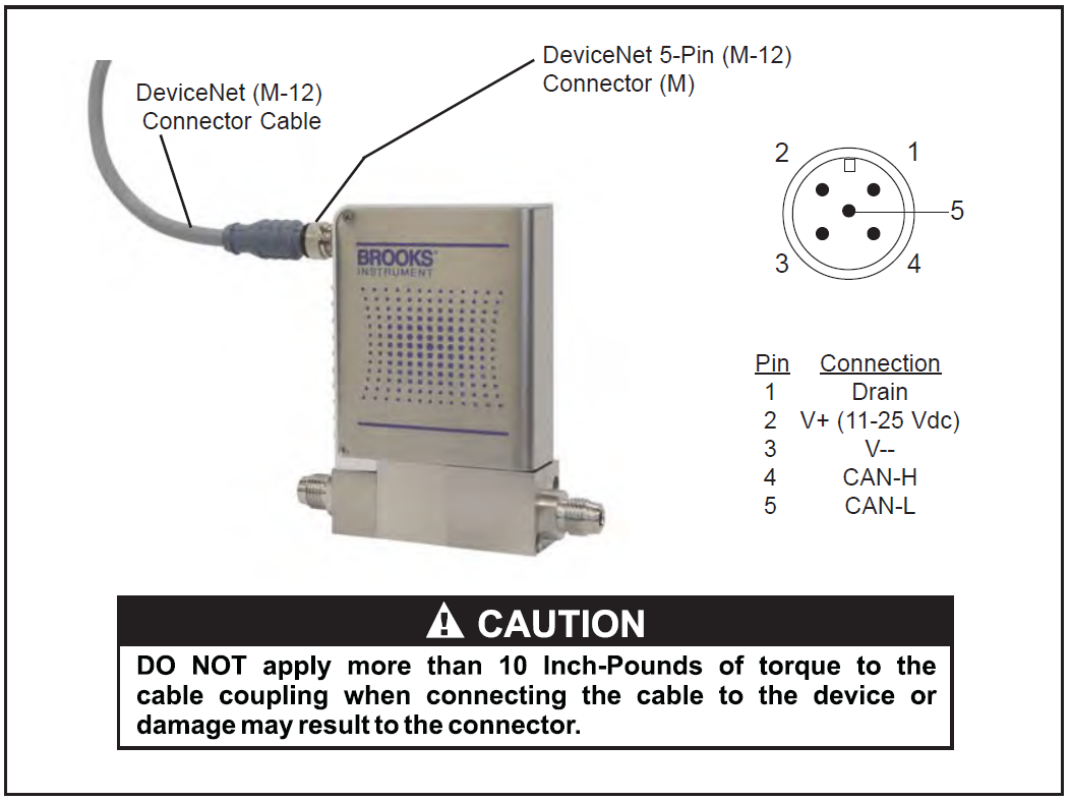



*Figure 2-9 PC100 Series DeviceNet Connection*

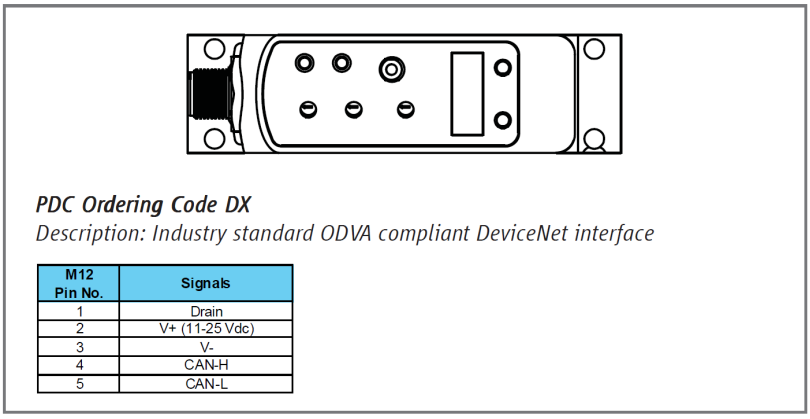
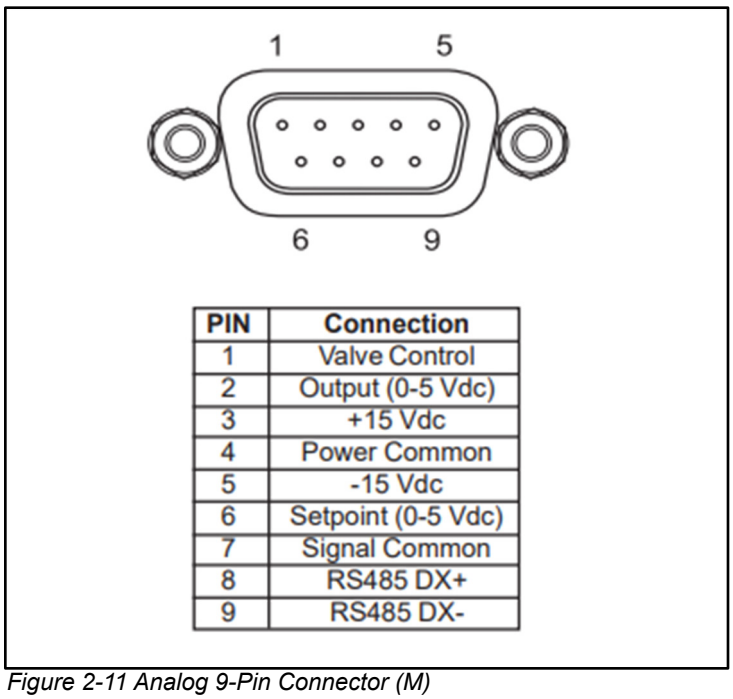



*Figure 2-10 PC100 Series Interface Options*

### Analog/RS485 Connections

The PC100 Series devices are available with Analog 9-Pin D-Connectors as shown in Figure 2-11.




| PIN | Connection |
|---|---|
| 1 | Valve Control |
| 2 | Output (0-5 Vdc) |
| 3 | +15 Vdc |
| 4 | Power Common |
| 5 | -15 Vdc |
| 6 | Setpoint (0-5 Vdc) |
| 7 | Signal Common |
| 8 | RS485 DX+ |
| 9 | RS485 DX- |

*Figure 2-11 Analog 9-Pin Connector (M)*

## General

After the device has been properly installed in the process, it is ready for operation. When initiating flow, slowly open any upstream shutoff valve to avoid a flow surge. A bypass is helpful in bringing the flow on smoothly. Avoid starting a pump to supply the device without the use of a valve upstream of the device.

**⚠WARNING**

**Before operating the flow controller, ensure all gas connections have been properly tightened and, where applicable, all electrical connections have been properly terminated.**

## Theory of Operation for Pressure Control

The PC100 Series measures pressure via its internal pressure transducer. When the system pressure changes, the PC100 Series will manipulate the flow to achieve and maintain pressure setpoint. Unlike traditional pressure control devices, the PC125 Pressure Controller leverages the mass flow measurement capability and sensor accuracy of the GF1xx Thermal Mass Flow series. For the downstream PC125 device, gas flow first travels through the control valve into the bypass. The gas flow entering the bypass is separated into two paths: one straight through the bypass and the other through the thermal sensor. Both gas flow paths are reunited at the outlet of the bypass in the same relative location to the pressure transducer port location. The PC125 provides accurate pressure control while providing the customer with accurate flow measurement.

## Overview

No routine maintenance is required on the Brooks PC100 Series devices. If an in-line filter is used, the filtering elements should be periodically replaced or cleaned. Any precision unit such as a flow controller requires occasional servicing, especially if it has been operating for an extended period of time. If reactive gases are being used, it is recommended that you send the device to a Brooks Service Center for cleaning and recalibration. Please follow the instructions for removal, product packaging and product return instructions found in Section 2- Installation—Return Shipment. All active process instrumentation and equipment is subject to aging and wear from their environment. This includes temperature, mechanical stress, component tolerance shift, contaminant buildup, oxidation, and other influences. The effects are gradual, but over time the changes can affect the accuracy of even the best equipment. Therefore, it is recommended to re-zero the device at 6 month intervals. Refer to Sections 2-14, 2-15 & 2-16 Performance Checks for re-zeroing instructions.

## Maintenance

**⚠ 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 personal 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 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 device only be serviced by properly trained and qualified personnel.

**⚠ 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 internal circuit boards of devices.

### Trouble Shooting

This section includes a Troubleshooting Checklist and a PC100 Series Troubleshooting Guide that identifies symptoms, possible causes, and corrective actions.

The PC100 is generally used as a component in gas delivering systems which can be quite complex. This can make the tasks of troubleshooting and isolating malfunctions in the system a difficult one. An incorrectly diagnosed problem can cause hours of unnecessary down time. When possible, follow the troubleshooting checks before removing a suspected defective pressure controller.

**⚠ NOTICE**

OEM tool problems are often caused by something other than the PC100 Series. Therefore, Brooks recommends that you review both the Troubleshooting Checklist and the PC100 Series Troubleshooting Guide before removing the PC100 Series from your system. It is also suggested to contact your Brooks Service representative before removing the PC100 Series from your system.

### Troubleshooting Checklist

1. Verify all electrical and communication connections are correct.
2. Ensure OEM tool setpoint matches the setpoint at the PC100 Series. Observe for consistency.
3. Verify isolations valves are open and the gas supply is turned on. Then verify operating pressures are within operating ranges.
4. Check PC100 Series pressure control by moving the setpoint back and forth. Observe for pressure changes.

**PC100 Series Troubleshooting Guide**

*Table 4-1 PC100 Series Troubleshooting Guide*

| Symptoms & Possible Causes | Corrective Action |
|---|---|
| **1. No pressure control and flow measurement.** | |
| Is the gas supply turned on? | Check shut-off valve and pressure readout. Open the gas supply. |
| Is the regulator turned on at the correct operating pressure? | Turn off the regulator and reset it to the recommended pressure as described in this manual. |
| Are any upstream or downstream shut-off valves closed, either by the system or because of failure? | Verify that the valves are open and operating properly. |
| Is the MOD LED light on the PC100 Series lit solid green? | Observe the LED display panel on top of to verify. If the LED light is not lit, cycle power the to reboot. |
| Is the commanded setpoint from tool/system at 0.00%? | Use the tool software to verify. |
| Has the PC100 been commanded off by an active “valve closed” input? | Use the tool software to verify. |
| **2. Pressure controller cannot achieve setpoint.** | |
| Is the gas inlet/outlet pressure differential either too high or too low? | Verify that the pressure is correct for the gas and range. If required, adjust inlet/outlet pressure to achieve proper pressure reading. |
| Is the MOD LED light on the PC100 Series lit solid green? | Observe the LED display panel at top of PC.<br>If the LED light is not lit, cycle power the to reboot. |
| Is the setpoint correct for the required gas flow? | Use the tool software to verify. |
| Is the zero correct? | Zero the according to zeroing procedure in Section 2-14. Verify leak check rates are OK. |
| **3. No gas control; flow is at or above maximum.** | |
| Is the gas pressure across the too high? | Verify that the pressure is correct for the gas and range. If required, adjust inlet/outlet pressure to achieve proper pressure reading. |
| Are system valves open, or is the purge input activated? | Use tool software to verify. |
| Is the setpoint correct for the required flow? | Use tool software to verify. |

*Table 4-1 PC100 Series Troubleshooting Guide (Continued)*

| Symptoms & Possible Causes | Corrective Action |
|---|---|
| **4. No pressure control above some setpoint.** | |
| NOTE: When the setpoint is increased beyond this point, the PC100 Series pressure signal remains at some value lower than the setpoint.<br>Is the gas inlet/outlet differential pressure sufficient? | Verify that the pressure is correct for the gas and range. If required, adjust regulator to achieve proper pressure |
| **5. No pressure control below some set-point.** | |
| NOTE: When the setpoint is decreased below this point, the<br>PC100 Series pressure signal remains at some value higher than the setpoint.<br>Is the gas inlet/outlet differential pressure too high, or above published setpoints? | Verify that the pressure is correct for this pressure range. If required, adjust regulator to achieve proper pressure |
| Is the PC100 Series leaking? | Check for contamination. Test the PC100 Series for leak integrity. Replace the PC100 Series if leakage is detected. |
| **6. PC100 Series pressure reading oscillates.** | |
| Is there too much gas pressure across the PC100 Series? | Verify that the pressure is correct for this gas and range. If required, adjust regulator to achieve proper pressure reading. |
| Are inlet and outlet pressures stable? | If outlet pressure is unstable, check for<br>(no oscillation or hunting) a faulty vacuum pump, or hunting at a downstream valve.<br>Check inlet pressure on tool. A faulty pressure regulator can make the<br>PC100 Series appear to oscillate.<br>Adjust inlet pressure up or down by 2 psig increments until hunting disappears.<br>Verify common gas pressure is within range. |
| **7. PC100 Series does not read zero pressure when gas is shut off.** | |
| Is the differential pressure across the PC100 Series really zero? | Verify that the pressure is correct for the gas and range. If the PC100 Series has been contaminated, it may not be able to close, and therefore, will not zero.<br>For PC125 flow meter, equalize the pressure across the<br>PC125 Series by opening it briefly. Set up the PC125 Series for zeroing.<br>Then perform the zeroing procedure in Section 2-14. |
| Is the PC125 Series mounted to the proper attitude? | Refer to the side can label on the PC125 Series.<br>The PC125 Series should be calibrated in the attitude it will be operating at. |

*Table 4-1 PC100 Series Troubleshooting Guide (Continued)*

| Symptoms & Possible Causes | Corrective Action |
|---|---|
| **8. OEM tool does not read correct PC100 Series pressure or flow meter zero reading.** | |
| Is the differential pressure across the PC100 Series really zero?<br>Is the PC100 Series mounted in the proper attitude?<br>Is the flow output signal of the PC125 Series really zero? | PC100 Series valve leakage.<br>Incorrect PC zero. |
| **9. Zero Drift.** | |
| Improper zero of the PC100 Series? | PC100 Series aging or sensor stabilization. |
| Excessive Valve leakage? | Zero is not correct. |
| **10. PC125 Flow Meter Calibration Drift.** | |
| Gas box temperature too high?<br>Is it linear offset? | Zero is not correct. |
| **11. PC100 Series indicates Overshoot.** | |
| Additional PID adjustments may be required per the application. | Contact the factory for support. |
| **12. Tool display output doesn't match PC125 Series flow meter output.** | |
| Improper zeroing of the PC125 flow meter? | Check PC125 Series zero. |

*Table 5-1 PC100 Series Product Description Code Table*

| Code Description | Code Option | Option Description |
|---|---|---|
| I. Base Model Code | PC115 | Pressure Controller |
| | PC125 | Pressure Controller with Flow Meter |
| II. Configurability | X | Specific Gas and Range Required |
| III. Flow Direction | U | Upstream Pressure Control Mode (For PC115 Only) |
| | D | Downstream Pressure Control Mode (For PC125 and PC115) |
| IV. Full Scale Pressure Range | 1000 | Full Scale Pressure Transducer Range, 1000 Torr |
| V. Full Scale Measurement Unit | T | Torr |
| VI. Reference Pressure | 0045 | Downstream Pressure Condition, psia - Default Setting |
| | 0004 | Upstream Pressure Condition, psia - Default Setting |
| VII. Pressure Measurement Unit | P | PSIA |
| VIII. Pressure Options | XXXXXXXX | Specific Gas Code ($H_2$, $N_2$, He, Ar) & Range, i.e. "0013" = Nitrogen and "010L" = 10 slpm |
| IX. Fitting | CX | 1-1/8" body width, 92mm C Seal |
| | WX | 1-1/8" body width, 92mm W Seal |
| | LX | 1-1/8" body width, 92mm C Seal w/Poke Yoke |
| X. Communications/Connector | BX | Cable adapter to 15 pin D Brooks* |
| | EX | Cable adapter to Card Edge (w/out VTP), RS485 through RJ11 jacks* |
| | FX | Cable adapter with 9 pin STEC pin-out & jack screws (w/ VTP)* |
| | GX | 9 pin D with RS485; display and overlay 180° orientation* |
| | G1 | 9 pin D with RS485* |
| | JX | Cable adapter with 9 pin STEC pin-out & jack screws (w/ VTP)* |
| | KX | Cable adapter to MKS 15 pin D* |
| | SX | 9 pin D with STEC pin-out (w/ VTP)* |
| | TX | 9 pin D with UDT9 pin-out* |
| | UX | Cable adapter to 15 pin D (w/ VTP)* |

| Option | Power On State | Full Scale Setting | Full Scale Setting | Full Scale Setting | Poll I/O Instance Producer | Poll I/O Instance Consumer | Poll I/O State Transition | External Baud Rate |
|---|---|---|---|---|---|---|---|---|
| D0 | Idle | Count | Integer | 6000h | 2 | 7 | Executing | 500KB |
| D1 | Idle | Count | Integer | 6000h | 21 | 7 | Executing | 500KB |
| D2 | Idle | SCCM | Float | 7FFFh | 13 | 19 | Executing | 500KB |
| D3 | Idle | Count | Integer | 6000h | 22 | 7 | Executing | 500KB |
| D4 | Executing | Count | Integer | 6000h | 22 | 8 | Executing | 500KB |
| D5 | Idle | Count | Integer | 6000h | 6 | 8 | Executing | 500KB |
| D6 | Idle | Count | Integer | 7FFFh | 3 | 7 | Executing | 500KB |
| D7 | Idle | Count | Integer | 7FFFh | 6 | 8 | Executing | 500KB |
| D8 | Idle | Count | Integer | 6000h | 3 | 7 | Executing | 500KB |
| D9 | Executing | Count | Integer | 6000h | 2 | 7 | Executing | 500KB |
| DA | Idle | Count | Integer | 7FFFh | 22 | 7 | Executing | 500KB |
| DB | Idle | Count | Integer | 6000h | 22 | 8 | Executing | 500KB |
| DC | Idle | Count | Integer | 7FFFh | 3 | 7 | Idle | 500KB |
| DD | Executing | Count | Integer | 7FFFh | 22 | 8 | Executing | 500KB |
| DE | Executing | SCCM | Float | 6000h | 15 | 19 | Executing | 500KB |

| | | |
|---|---|---|
| | DX | To be defined by Customer Special Request |
| XI. Customer Special Request | XXXX | Customer Special Request Number |
| XII. Reference Temperature | 000 | 0°C Reference Calibration (Standard) - Default Setting |
| XIII. Firmware | XXX | Firmware Revision |
| | LFW | Latest Firmware Revision |
| | CSR | Firmware Defined by Customer Special Request in Section XI |

* For PC115 Only

Sample Model Code

| I | II | III | | IV | V | VI | VII | | VIII | | IX | X | | XI | | XII | | XIII |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PC125 | X | D | - | 1000 | T | 0045 | P | - | 0013 010L | - | VX | D0 | - | XXXX | - | 000 | - | LFW |

LIMITED WARRANTY
Visit www.BrooksInstrument.com for the terms and conditions of our limited warranty.

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