

## Data Sheet

# XacTorr® Series Models CMX0, CMX45 and CMX100

## Vacuum Capacitance Manometers

## Rugged, Stable Digital Capacitance Manometers for Process Vacuum Measurement

### Overview

Brooks XacTorr® CMX Series digital vacuum capacitance manometers (also referred to as capacitance diaphragm gauges) incorporate industry-leading features that improve measurement reliability, minimize drift, resist diaphragm contamination, and minimize thermal effects. The result is an exceptionally reliable capacitance manometer family for all vacuum measurement applications.

An important benefit of the XacTorr vacuum capacitance manometer is its advanced Mark-IV sensor. The sensor chamber contains surface areas that are not used in the pressure measurement; these surfaces provide locations for particles and condensable vapors to accumulate without affecting the sensor, dramatically reducing the need for re-zeroing and greatly extending sensor life. The sensor diaphragm is made from corrosion resistant Inconel®.

Because they are fully digital devices, XacTorr vacuum capacitance manometers operate over a wide dynamic range with extremely good accuracy.

### Product Description

Flexible digital signal processor based electronics eliminates manual potentiometers and drift associated with the aging of old-style analog electronics.

Digital precision:

- Multi-decade digital calibration provides superior window of "known accuracy"
- Real-time compensation for ambient temperature variations which improves measurement repeatability
- Intelligent zero adjustment, local push-button, and remote zeroing for ease of maintenance capability that also improves long-term repeatability

Intelli-Touch zeroing ensures that the XacTorr Series cannot be zeroed if the pressure is too high or if the capacitance manometer has not reached a stabilized operating temperature - a common operator error with analog capacitance manometers.

Highly efficient dual-zone temperature control:

- Real-time temperature control of the sensor for improved measurement stability & repeatability
- Fast warm-up with intuitive temperature status LED
- Rapid response to changing system conditions

Unique corrosion resistant, shielded sensor design offers superior protection against condensable process by-products, which will degrade accuracy and shorten the life of the instrument.



XacTorr®  
Digital Capacitance Manometer

## Features and Benefits

### Digital Calibration

- Automated calibration improves gauge to gauge reproducibility
- Improved process reproducibility

### In-situ Diagnostics & Independent Data Port

- Provides a simple non-invasive method for maintenance and troubleshooting

### Dual Zone Temperature Control

- Rapid compensation for changes in process temperature
- Fast warm-up
- Fast recovery from venting to high pressure

### Digital Architecture

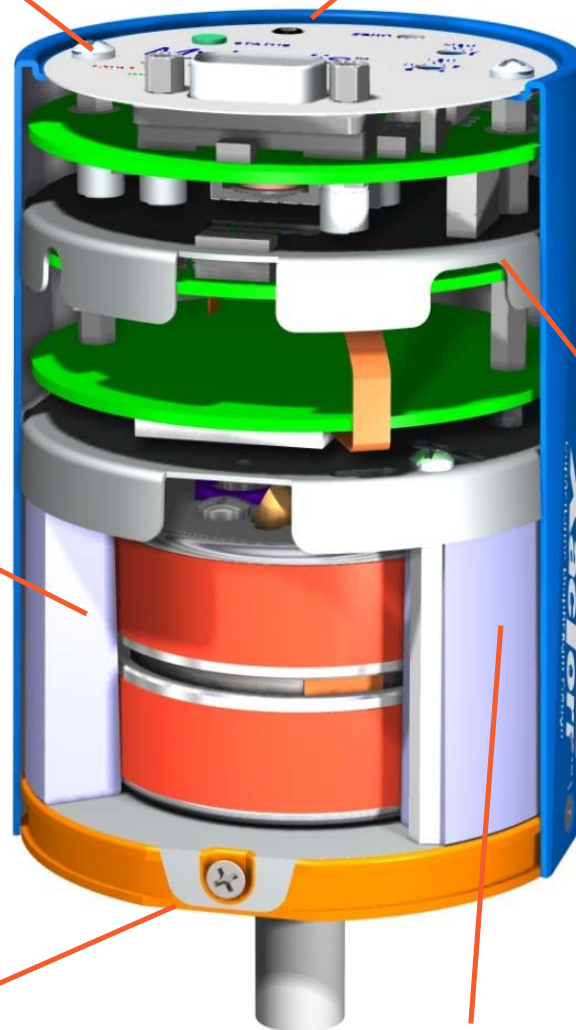
- Virtually eliminates the drift associated with the aging of analog electronics
- Virtually eliminates the temperature effects associated with discrete analog components

### Plasma Shield

- Protects the entire surface area of the diaphragm from the build-up of process byproducts and particulates

### Mark IV Sensor

- Guard Volume - provides a "buffer zone" to protect the diaphragm from the build-up of process deposition and particulates
- Eliminates the build-up of stress within the reference measurement cavity

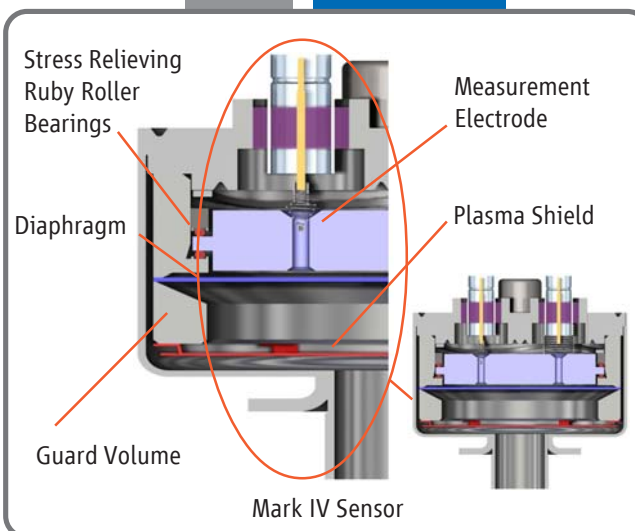


| Features                      | Benefits                                                                                                            |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Patented Mark IV Sensor       | Lower drift, superior protection from deposition of process gases                                                   |
| Dual Zone Temperature Control | Fast warm-up, close temperature control, rapid response to changes                                                  |
| Digital Calibration           | Multi decade calibration provides superior window of known accuracy, real time compensation of ambient temp effects |
| Digital Architecture          | Eliminates manual potentiometers and drift associated with electronics                                              |
| Intelli-Touch Zero Adjustment | Cannot be zeroed if pressure is too high or desired temperature not reached                                         |

## Product Description

### Patented Mark IV Sensor

The XacTorr capacitance manometers utilize patented sensor technology. Unique corrosion resistant, shielded sensor design offers superior protection against condensable process byproducts. The sensor diaphragm is made from corrosion resistant Inconel®. This allows for extended operation of the capacitance manometers without degrading accuracy.

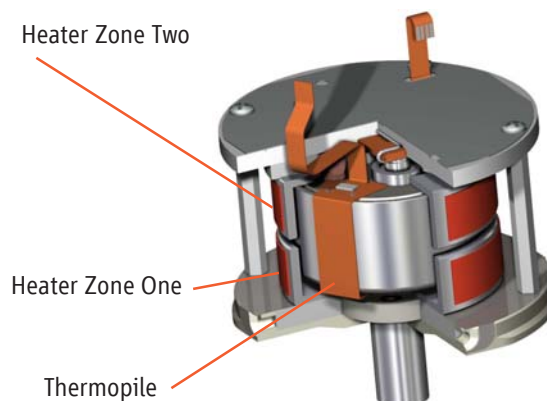


### Highly Efficient Dual Zone Temperature Control

The XacTorr capacitance manometers are offered with sensors that operate either at ambient temperature or at an elevated but regulated temperature. In case of the latter, two options are offered, 45°C, or 100°C. Brooks utilizes a highly efficient dual zone temperature control system to maintain the sensor diaphragm to within 0.1°C of the specified temperature. Such real time and close temperature control improves measurement stability and repeatability.

This temperature management system also allows for fast warm up. An LED indicates when the instrument reaches the desired temperature level allowing for reliable measurements to be made.

The dual zone control also ensures rapid response to changing system conditions.



Dual Zone Temperature Control:  
Precisely measures the reference temperature and  $\Delta T$

### Flexible Digital Signal Processor

The XacTorr capacitance manometers incorporate patented advanced digital architecture. This eliminates manual potentiometers and drift associated with the aging of old style analog electronics.

The instrument is calibrated using multi decade digital calibration which provides a superior window of known accuracy.

The digital precision allows for real time compensation of ambient temperature effect for improved measurement repeatability.

The Intelli-Touch zeroing ensures that the XacTorr capacitance manometers cannot be zeroed if the pressure is too high or if the gauge has not reached stabilized operating temperature. This is a common source of operator error with analog capacitance manometers.

The gauge offers a local push button and remote zeroing for ease of maintenance and for improved long term repeatability.



Flexible Digital Signal Processor

## Product Description

### Independent Communications and Diagnostic Interface

The XacTorr's RS-485 diagnostic port provides a unique, independent means of communicating with the gauge without having to "interrupt" tool communications. This allows monitoring and data acquisition capabilities simultaneously with gauge operation, for chamber and tool matching along with "real time" advanced troubleshooting.



## Product Specifications

### Performance

|                            |                                                                                                                    |
|----------------------------|--------------------------------------------------------------------------------------------------------------------|
| Operating Temperatures:    |                                                                                                                    |
| CMX0                       | Ambient                                                                                                            |
| CMX45                      | 45°C                                                                                                               |
| CMX100                     | 100°C                                                                                                              |
| Full Scale Ranges          | 0.1, 1, 2, 10, 20, 100, 1000 Torr                                                                                  |
| Accuracy <sup>1</sup>      | CMX0: 0.25% of Reading<br>CMX1, CMX2: 1 to 1000 Torr Ranges = 0.15% of Reading, < 1 Torr Ranges = 0.25% of Reading |
| Measurement Range          | 4 Decades                                                                                                          |
| Temperature Effect on Zero | 0.002% F.S./°C                                                                                                     |
| Temperature Effect on Span | 0.02% F.S./°C                                                                                                      |

### Mechanical

|                             |                                                     |
|-----------------------------|-----------------------------------------------------|
| Exposed Materials           | Inconel® and/or AISI 316L Stainless Steel           |
| Over-Pressure Limit         | 17 psia or 125% of Full Scale, whichever is greater |
| Approximate Shipping Weight | 1.40 lbs. (726 grams)                               |

### Outputs Supported

|                  |                                         |
|------------------|-----------------------------------------|
| Analog Models    | Analog (010 Vdc 5k $\Omega$ load) - Yes |
|                  | RS485 - Yes                             |
|                  | DeviceNet - No                          |
| DeviceNet Models | Analog (010 Vdc 5k $\Omega$ load) - Yes |
|                  | RS485 - Yes                             |
|                  | DeviceNet - Yes                         |

### Connectors

|           |                                                          |
|-----------|----------------------------------------------------------|
| Analog    | 9-Pin Male Sub D or 15-Pin Sub D                         |
| RS485     | 2.5mm Mini Jack                                          |
| DeviceNet | 5-Pin Eurofast (DeviceNet) & 9-Pin Female Sub D (Analog) |

### Relay Contact Rating

|                                          |                            |
|------------------------------------------|----------------------------|
| Available on 15-Pin Male Sub D interface | 1A @ 30 Vdc/0.3A @ 125 Vac |
|------------------------------------------|----------------------------|

### Environmental

|                               |                 |
|-------------------------------|-----------------|
| Ambient Operating Temperature | CMX0: 0-50°C    |
|                               | CMX45: 15-35°C  |
|                               | CMX100: 15-45°C |

### Certifications

|                               |                                                |
|-------------------------------|------------------------------------------------|
| Electromagnetic Compatibility | Fully CE Certified to EMC Directive 89/336/EEC |
| RoHS Compliance               | With "R" in the Part Number Code               |

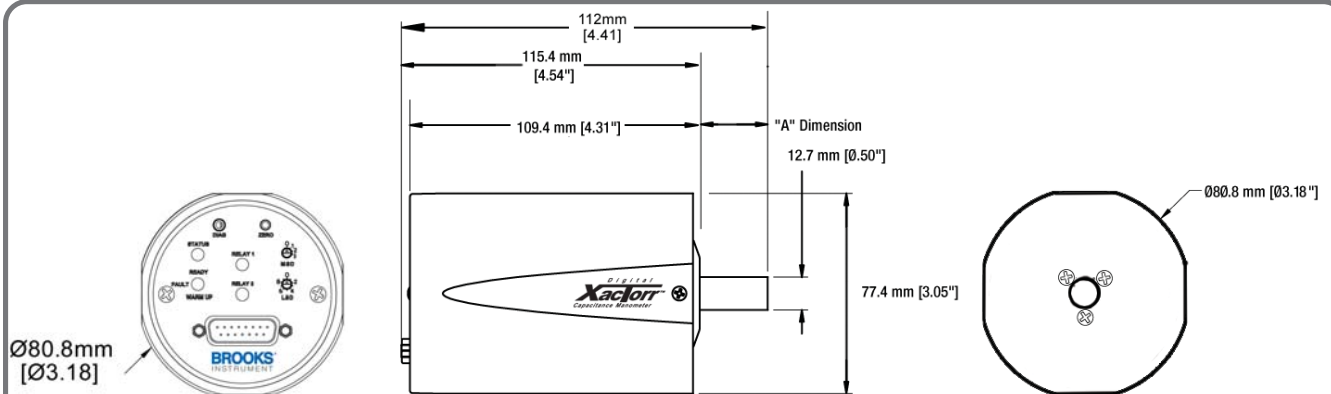
### Power Required

|                                                                           |                                             |                                              |
|---------------------------------------------------------------------------|---------------------------------------------|----------------------------------------------|
| CMX0 power required is 200 mA @ $\pm 15$ Vdc                              |                                             |                                              |
| Power Input at Initial Warm-up Analog Models, Typical Values <sup>2</sup> | CMX45 - 270 mA @ $\pm 15$ Vdc ( $\pm 5\%$ ) | CMX100 - 620 mA @ $\pm 15$ Vdc ( $\pm 5\%$ ) |
| Power Input at Steady State Analog Models, Typical Values <sup>2</sup>    | CMX45 - 175 mA @ $\pm 15$ Vdc ( $\pm 5\%$ ) | CMX100 - 350 mA @ $\pm 15$ Vdc ( $\pm 5\%$ ) |
| Power Input at Initial Warm-up DeviceNet Models, Typical Values           | CMX45 - 400 mA @ 24 Vdc                     | CMX100 - 900 mA @ 24 Vdc                     |
| Power Input at Steady State DeviceNet Models, Typical Values              | CMX45 - 300 mA @ 24 Vdc                     | CMX100 - 600 mA @ 24 Vdc                     |

Notes:

1. Includes Hysteresis, linearity and repeatability within the calibrated range at 21°C specification for 1000 Torr tentative pending final qualification.
2. 15-Pin Male Sub D Model requires an additional 40 mA to power the internal relays (if energized).

## Product Dimensions - Analog Models



| Fitting Type | Fitting Code | "A" Dimension   |
|--------------|--------------|-----------------|
| .05" OD Tube | 0            | 26.3mm (1.04")  |
| KF-10 Flange | 1            | 39.0mm (1.54")  |
| KF-16 Flange | 2            | 39.0mm (1.54")  |
| KF-25 Flange | 3            | 30.1mm (1.19")  |
| 8 VCR Female | 4            | 52.24mm (2.06") |
| Mini CF      | 5            | 27.56mm (1.09") |

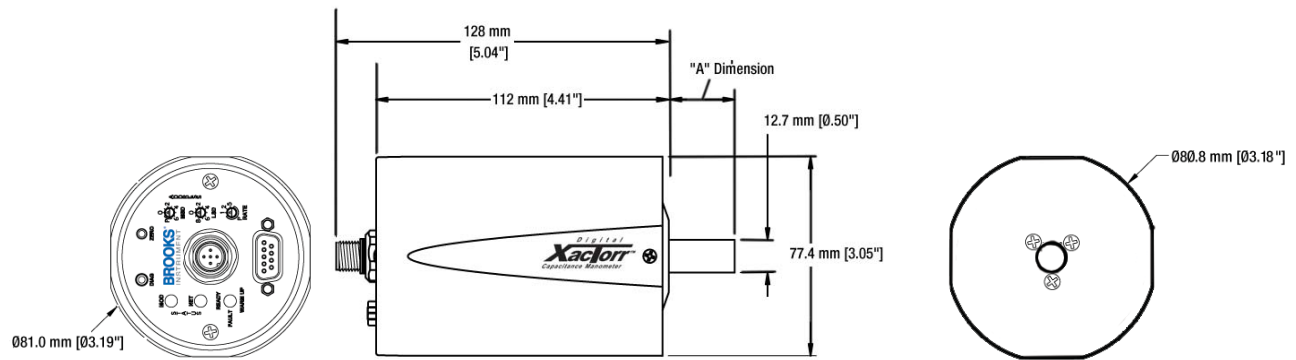


| Port                              | Pinout | Description         |
|-----------------------------------|--------|---------------------|
| Analog Port<br>(9-pin Male D Sub) | 1      | Pressure Output     |
|                                   | 2      | Not Used            |
|                                   | 3      | Temperature Status  |
|                                   | 4      | +15 Vdc Supply      |
|                                   | 5      | -15 Vdc Supply      |
|                                   | 6      | Case Ground         |
|                                   | 7      | Remote Zero         |
|                                   | 8      | Signal Common       |
|                                   | 9      | Power Supply Common |
| RS-485 Port<br>(2.5mm Jack)       | Tip    | RS_A                |
|                                   | Ring 1 | RS_B                |
|                                   | Sleeve | Ground              |



| Port                               | Pinout | Description             |
|------------------------------------|--------|-------------------------|
| Analog Port<br>(15-pin Male D Sub) | 1      | Temperature Status      |
|                                    | 2      | Pressure Output         |
|                                    | 3      | Remote Zero             |
|                                    | 4      | Not Used                |
|                                    | 5      | Power Supply Common     |
|                                    | 6      | -15 VDC Supply          |
|                                    | 7      | +15 VDC Supply          |
|                                    | 8      | Relay 1-Normally Open   |
|                                    | 9      | Relay 1-Common          |
|                                    | 10     | Relay 1-Normally Closed |
|                                    | 11     | Relay 2-Normally Open   |
|                                    | 12     | Signal Common           |
|                                    | 13     | Relay 2-Common          |
|                                    | 14     | Relay 2-Normally Closed |
|                                    | 15     | Case Ground             |
| RS-485 Port<br>(2.5mm Jack)        | Tip    | RS_A                    |
|                                    | Ring 1 | RS_B                    |
|                                    | Sleeve | Ground                  |

## Product Dimensions - DeviceNet Models



| Fitting Type | Fitting Code | "A" Dimension   |
|--------------|--------------|-----------------|
| .05" OD Tube | 0            | 26.3mm (1.04")  |
| KF-10 Flange | 1            | 39.0mm (1.54")  |
| KF-16 Flange | 2            | 39.0mm (1.54")  |
| KF-25 Flange | 3            | 30.1mm (1.19")  |
| 8 VCR Female | 4            | 52.24mm (2.06") |
| Mini CF      | 5            | 27.56mm (1.09") |



| Port                               | Pinout                                    | Description                                                                                                                          |
|------------------------------------|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| DeviceNet Port<br>(5-pin Eurofast) | 1<br>2<br>3<br>4<br>5                     | Drain<br>V+<br>V-<br>CAN_H<br>CAN_L                                                                                                  |
| Analog Port<br>(9-pin D Sub)       | 1<br>2<br>3<br>4<br>5<br>6<br>7<br>8<br>9 | Pressure Output<br>Not Used<br>Temperature Status<br>Not Used<br>Not Used<br>Case Ground<br>Remote Zero<br>Signal Common<br>Not Used |
| RS-485 Port<br>(2.5mm Jack)        | Tip<br>Ring 1<br>Sleeve                   | RS_A<br>RS_B<br>Ground                                                                                                               |

| DeviceNet*                      |                                                                                                                                                                                                  |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Rate/Network Length        | User Selectable: 125 kbps, 500m (1,640ft.), 250 kbps, 250m (820ft.), 500 kbps, 100m (328ft.)                                                                                                     |
| Digital Functions               | Read Pressure, set zero, reset factory defaults, report run time (hours), change device address and baud rate                                                                                    |
| Data Rate Switch                | 4 positions: 125, 250, 500k, PGM (programmable over the network)                                                                                                                                 |
| MAC ID Switches                 | 2 switches, 10 positions each, 00 to 63 are valid MAC ID (addresses) numbers; Switch settings from 64 through 99 are in the PMG range, and the MAC ID can then be programmable over the network. |
| Network Message Size            | Master/Slave information flow (Group 2 only server)                                                                                                                                              |
| Network Size                    | Up to 64 nodes                                                                                                                                                                                   |
| Network Topology                | Linear (trunkline/dropline) power and signal on same network cable                                                                                                                               |
| Visual Communication Indicators | LED network status (green/red), LED module status (green/red)                                                                                                                                    |

\*Meets SEMI E54 and ODVA SEMI SIG vacuum gauge profile

## Model Code

| Code Description               | Code Option | Option Description                                                                                           |
|--------------------------------|-------------|--------------------------------------------------------------------------------------------------------------|
| I. Base Model Code             | <b>CMX</b>  | Capacitance Manometer                                                                                        |
| II. Model/Ordering Temperature | <b>0</b>    | CMX0 (Ambient)                                                                                               |
|                                | <b>1</b>    | CMX45 (45°C)                                                                                                 |
|                                | <b>2</b>    | CMX100 (100°C)                                                                                               |
| III. Full Scale Range          | <b>M11*</b> | 100 mTorr                                                                                                    |
|                                | <b>M25</b>  | 250 mTorr                                                                                                    |
|                                | <b>M50</b>  | 500 mTorr                                                                                                    |
|                                | <b>T01</b>  | 1 Torr                                                                                                       |
|                                | <b>T02</b>  | 2 Torr                                                                                                       |
|                                | <b>T05</b>  | 5 Torr                                                                                                       |
|                                | <b>T07</b>  | 7.5 Torr                                                                                                     |
|                                | <b>T11</b>  | 10 Torr                                                                                                      |
|                                | <b>T12</b>  | 20 Torr                                                                                                      |
|                                | <b>T15</b>  | 50 Torr                                                                                                      |
|                                | <b>T21</b>  | 100 Torr                                                                                                     |
|                                | <b>T22</b>  | 200 Torr                                                                                                     |
|                                | <b>T23</b>  | 300 Torr                                                                                                     |
|                                | <b>T31</b>  | 1000 Torr                                                                                                    |
|                                | <b>PX1*</b> | 13.33 Pa (100 mTorr)                                                                                         |
|                                | <b>PX2</b>  | 33.32 Pa (250 mTorr)                                                                                         |
|                                | <b>PX5</b>  | 66.65 Pa (500 mTorr)                                                                                         |
|                                | <b>P01</b>  | 133.3 Pa (1 Torr)                                                                                            |
|                                | <b>P02</b>  | 266.6 Pa (2 Torr)                                                                                            |
|                                | <b>P05</b>  | 666.6 Pa (5 Torr)                                                                                            |
|                                | <b>P11</b>  | 1.333 kPa (10 Torr)                                                                                          |
|                                | <b>P12</b>  | 2.666 kPa (20 Torr)                                                                                          |
|                                | <b>P21</b>  | 13.33 kPa (100 Torr)                                                                                         |
|                                | <b>P31</b>  | 133.3 kPa (1000 Torr)                                                                                        |
| IV. Electrical Connector       | <b>1</b>    | 9 Pin Male Sub D                                                                                             |
|                                | <b>2</b>    | 15 Pin Male Sub D                                                                                            |
|                                | <b>3</b>    | DeviceNet with 9-Pin Female Sub D, Default Configuration, Real Data                                          |
|                                | <b>4</b>    | 15-Pin D Sub Connector with 2 Process Relays and a Temperature in Control Relay                              |
|                                | <b>5</b>    | 15-Pin D Sub Connector with 1 Process Relay, 1 Temperature in Control Relay, and an Overheat Indicator Relay |
| V. Fitting                     | <b>0</b>    | 0.5" OD Tube Stub (No Fitting)                                                                               |
|                                | <b>1</b>    | KF 10 Flange                                                                                                 |
|                                | <b>2</b>    | KF 16 Flange                                                                                                 |
|                                | <b>3</b>    | KF 25 Flange                                                                                                 |
|                                | <b>4</b>    | 8 VCR (1/2") Female                                                                                          |
|                                | <b>5</b>    | Mini CF                                                                                                      |
|                                | <b>N</b>    | 4 VCR (1/4") Female                                                                                          |
| VI. Calibration                | <b>V</b>    | Vertical                                                                                                     |
| VII. Compliance                | <b>R</b>    | RoHS Compliant                                                                                               |

Include Option Code "R" in the CMX Part Number field in order to receive RoHS Compliant devices.  
Option "R" is not available for 9-pin or DeviceNet Connector options.

### Sample Model Code

| I   | II | III | IV | V | VI | VII |                           |
|-----|----|-----|----|---|----|-----|---------------------------|
| CMX | 1  | M11 | 2  | 1 | V  | R   | Required for RoHS Devices |

\* Available with 45° & 100°C only.

## Brooks Service and Support

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

Visit [www.BrooksInstrument.com](http://www.BrooksInstrument.com) to locate the service location nearest to you.

### START-UP SERVICE AND IN-SITU CALIBRATION

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

### SEMINARS AND TRAINING

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

*Please contact your nearest sales representative for more details.*

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

### TRADEMARKS

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### PATENTS

Advanced Digital Architecture: 6,910,381; 7,010,983; 7,490,518

Digital Temperature Control: 6,701,790; 7,729,628

Improved Sensitivity to Temperature and Humidity: 6,734,659

Mark IV Sensor: 4,823,603



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