BROOKS® INSTRUMENT

*Beyond Measure*

# GP200 Series

## Metal Sealed, Digital, Ultra-High Purity Pressure-based Mass Flow Controllers for Gases


GP200 Series is the first inlet and outlet pressure insensitive P-MFC, designed specifically for semiconductor applications. Its unique differential pressure sensor technology, coupled with its downstream valve architecture, removes the current limitations of pressure-based mass flow controllers.

Our sophisticated, proprietary MultiFlo™ gas model is embedded within each GP200 enabling on-the-fly gas & range reconfiguration for maximum process flexibility, while its ultra-fast, highly repeatable matched transient response and dynamic cross-talk insensitivity enables tighter process control. The GP200 platform provides the most precise process gas delivery over the widest range of operating conditions in the industry for seamless drop-in replacement and upgrade of traditional pressure-based mass and thermal flow controllers.

| Features | Benefits |
|---|---|
| True Differential Pressure Measurement | Brooks patented differential pressure sensor reduces the measurement uncertainty associated with separate absolute sensors, for enhanced accuracy and repeatability. |
| Lower Inlet Pressure Option | Low pressure drop laminar flow element and DP sensor enables accurate measurement of critical low pressure etch gases including $SiCl_4$, $BCl_3$, $C_4F_6$ |
| Cross-Talk Insensitive | During extreme pressure supply disruptions of up to 40 psi/sec, flow rate will be held within ≤±1% of setpoint to maintain process control. |
| Matched Transient Response | Ultra-fast and highly repeatable ascending and descending flow stabilization enables tighter process control. |
| Downstream Valve Architecture | Downstream valve architecture enables flow delivery into high pressures (up to 1200 Torr) and fast-closing valve reduces non-productive recipe wait times that are found in upstream MFC valve designs. |
| Zero Leak-by Control Valve | Valve shut down (up to ≤0.005% of full scale) to minimize the first wafer effect, improve tool matching, and wafer-to-wafer uniformity |
| High Flow Rate Capability | Supports all process flow needs with just nine (9) standard bin configurations for maximum flexibility |

# Product Specifications

## Performance

| | | |
|---|---|---|
| Full Scale Flow Range | 3 sccm to 50,000 sccm F.S. $N_2$ Equivalent | |
| Process Gas Flow Accuracy[1] | **Zero Leak Valve:**<br><±1% S.P. (5 – 100% F.S.)<br><±0.05% F.S. (0.5 - 5% F.S.) | **Metal Seal Valve:**<br><±1% S.P. (5-100% F.S.)<br><±0.05% F.S. (2-5% F.S.) |
| Control Range[2] | 0.5 - 100% F.S. | 2 - 100% F.S. |
| Repeatability & Reproducibility | 5-100% = ±0.15% of S.P.<br>0.5-5% = ±0.015% of F.S | 5-100% = ±0.15% of S.P.<br>2-5% = ±0.015% of F.S |
| Transient Response & Flow Settling Time | 280 ±20 ms Matched Transient Response, for any ascending or descending non-zero setpoint<br>(Fast Response Option available via Customer Special Request.) | |
| Valve Leak-by | **Zero Leak Valve:**<br><0.005% of F.S. of the bin (Bins 42-46)<br><0.02% of F.S. of the bin (Bins 40-41)<br>(@ 45 psia to VAC) | **Metal Seal Valve:**<br><0.15% of F.S. of the bin<br>(@ 45 psia to VAC) |
| Supply Pressure Insensitivity/Cross-Talk | <±1% S.P. up to 40 psi/sec inlet pressure spike | |
| Steady State Back Pressure Insensitivity | Insensitive to steady state back pressure | |
| Dynamic Back Pressure Insensitivity | Maintains accuracy during disturbance from vacuum to 1200 Torr over a period of 1 sec | |
| Zero Stability | <±0.15% F.S. per year | |
| Temperature Coefficient | Zero: 0.005% F.S. per °C<br>Span: 0.05% S.P. per °C | |
| Number of Standard Configurations | Nine (9) standard bin ranges | |
| Dynamic Gas and Range Programmability | Device may be configured via single tool command in less than 1 second<br>or via BEST software with independent USB diagnostic port | |
| Attitude Insensitivity | Insensitive to device orientation after re-zeroing | |

## Ratings

| | |
|---|---|
| Operating Temperature Range[3] | 10 – 60°C |
| Operating Inlet Pressure[4] | <15 psia for Low Pressure (LP) bins, configurable based on application<br>15 to 30 psia<br>25 to 40 psia<br>35 to 50 psia<br>45 to 60 psia |
| Operating Outlet Pressure[3] | Vacuum to Atmosphere<br>Up to 1200 Torr for some applications |
| Differential Pressure Range | Min: 7 psid typical Max: up to 50 psid |
| External Leak Integrity | 1 x $10^{-10}$ atm cc/sec He |
| Proof Pressure | 100 psia, CT Bin Devices<br>(70 psia for Helium and Helium mixtures on CT Bin Devices)<br>45 psia, LP Bin Devices |
| Design Pressure | 150 psia |
| Burst Pressure | 1000 psia |

## Mechanical

| | |
|---|---|
| Valve Type | Normally Closed |
| Wetted Materials | 316L, Hastelloy C-22, 316/316L Stainless Steel, 304 Stainless Steel, KM-45, PCTFE |
| Surface Finish | 5µ inch Ra avg. |

[1] For analog control, adder of <±0.05% F.S. applies
[2] For best performance lowest controllable setpoint should be equivalent to 1% FS of the bin at 35 psia for bins CT40/LP40 due to extreme low flow. This is equivalent to 0.1 sccm $N_2$
[3] Device should be zeroed at ambient operating temperature per Brooks Instrument recommended procedure
[4] Consult Brooks Configurator and Bin Tables for specific product sizing and configurable, gas-specific, inlet pressure options.

# Product Specifications

### Diagnostics & Display

| | |
|---|---|
| Status Lights | DeviceNet: MFC Health, Network Status<br>EtherCAT: Run, Error, Power, Network Status<br>Analog/RS485: Network Status |
| Alarms[5] | Process Control Deviations, Flow High/Low, Temperature High/Low, Pressure High/Low, Voltage Input High/Low, Communication Alarms, Hardware Failures, Page Create Errors, Warmup Alarm (alarms are model specific) |
| Display Type | Top Mount Integrated LCD |
| Viewing Angle/Viewing Distance | Rotatable / 10 ft |
| Units Displayed/Resolution | Flow (%), Temp. (°C), Pressure (psia, kPa) / 0.1 (unit) |

### Electrical

| | |
|---|---|
| Digital Communication | DeviceNet™, EtherCAT®, RS485 (model specific) |
| Electrical Connection | DeviceNet™ via 5-Pin M12 connector<br>EtherCAT® via RJ45 jacks, Power via 5-pin M8 connector<br>0-5V Analog/RS485 (L-Protocol) via 9-pin D-Connector |
| Independent Diagnostics Service Port | RS485 via micro-USB |
| DeviceNet Power Supply/Consumption | 545mA max. @ +11-25 Vdc, 250mA max. @ 24 Vdc<br>(under typical operating conditions) |
| EtherCAT Power Supply/Consumption | 360mA max @ +18-30 Vdc, 270mA max @ 24 Vdc<br>(under typical operating conditions) |
| Analog/RS485 Power Supply/ Consumption | 6 Watts max @ ± 15 Vdc (±10%) or +24Vdc (±10%)<br>(under typical operating conditions) |

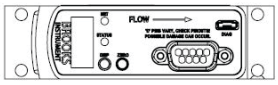
### Compliance

| | |
|---|---|
| EMC | 2014/30/EU EMC Directive EN:61326-1: 2013 |
| Environmental Compliance | 2011/65/EU & 2015/863/EU RoHS Directive<br>EC 1907/2006 REACH Directive |

[5] For full list of alarms available consult GP200 Supplemental Communication Manuals at www.BrooksInstrument.com

# Electrical Interface Options

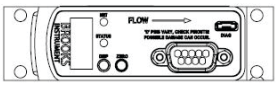
**Base I/O Options**



*Description: Industry standard Analog / RS485 interface*

**Model Code Option: G1**

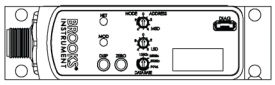
| Pin | Signals | |
|---|---|---|
| 1 | Valve Control | |
| 2 | Output (0-5 Vdc) | |
| 3 | +15 Vdc | +24 Vdc |
| 4 | Pwr Com | NC |
| 5 | -15 Vdc | Pwr Com |
| 6 | Setpoint (0-5 Vdc) | |
| 7 | Signal Common | |
| 8 | RS-485 (DX+) | |
| 9 | RS-485 (DX-) | |



*Description: Industry standard Analog only interface*

**Model Code Option: TX**

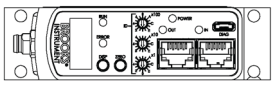
| Pin | Signals | |
|---|---|---|
| 1 | Valve Control | |
| 2 | Output (0-5 Vdc) | |
| 3 | +15 Vdc | +24 Vdc |
| 4 | Pwr Com | NC |
| 5 | -15 Vdc | Pwr Com |
| 6 | Setpoint (0-5 Vdc) | |
| 7 | Signal Common | |
| 8 | No Connection | |
| 9 | No Connection | |



*Description: Industry standard ODVA compliant DeviceNet interface*

**Model Code Option: DX**

| Pin | Description |
|---|---|
| 1 | Drain |
| 2 | V+ (11 - 25 Vdc) |
| 3 | V- |
| 4 | CAN-H |
| 5 | CAN-L |



*Description: Industry standard EtherCAT*

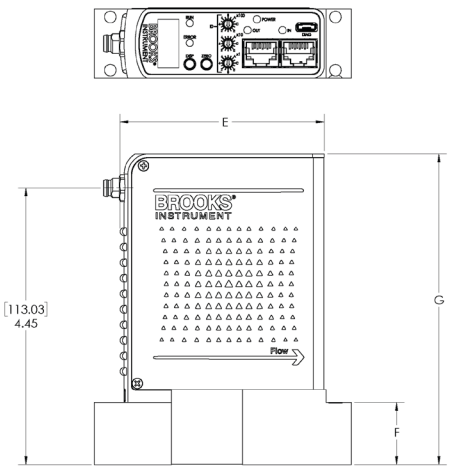
**Model Code Option: E0**

| Pin | Signals |
|---|---|
| 1 | +24V |
| 3 | Power Common |

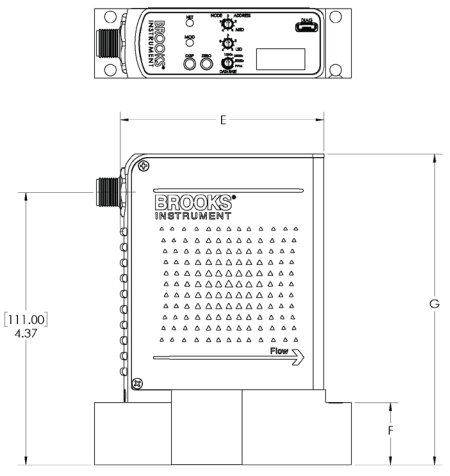
# Product Dimensions

## GP200 Series - Downport Configurations

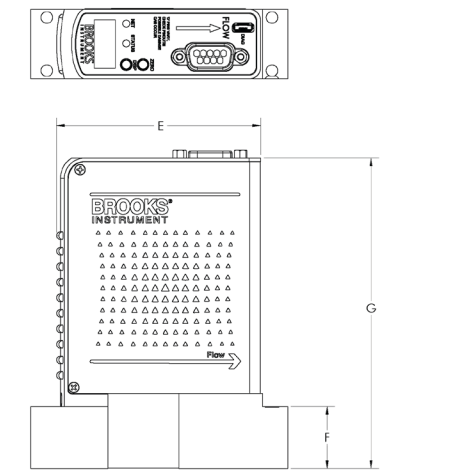
ELECTRICAL CONNECTOR
E0 SPECIFIC DIMENSIONS

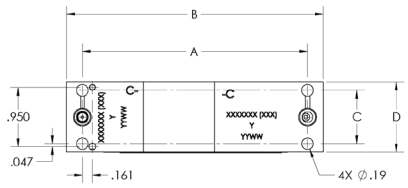



ELECTRICAL CONNECTOR
DX, D0-DE SPECIFIC DIMENSIONS




ELECTRICAL CONNECTOR
G1/TX SPECIFIC DIMENSIONS



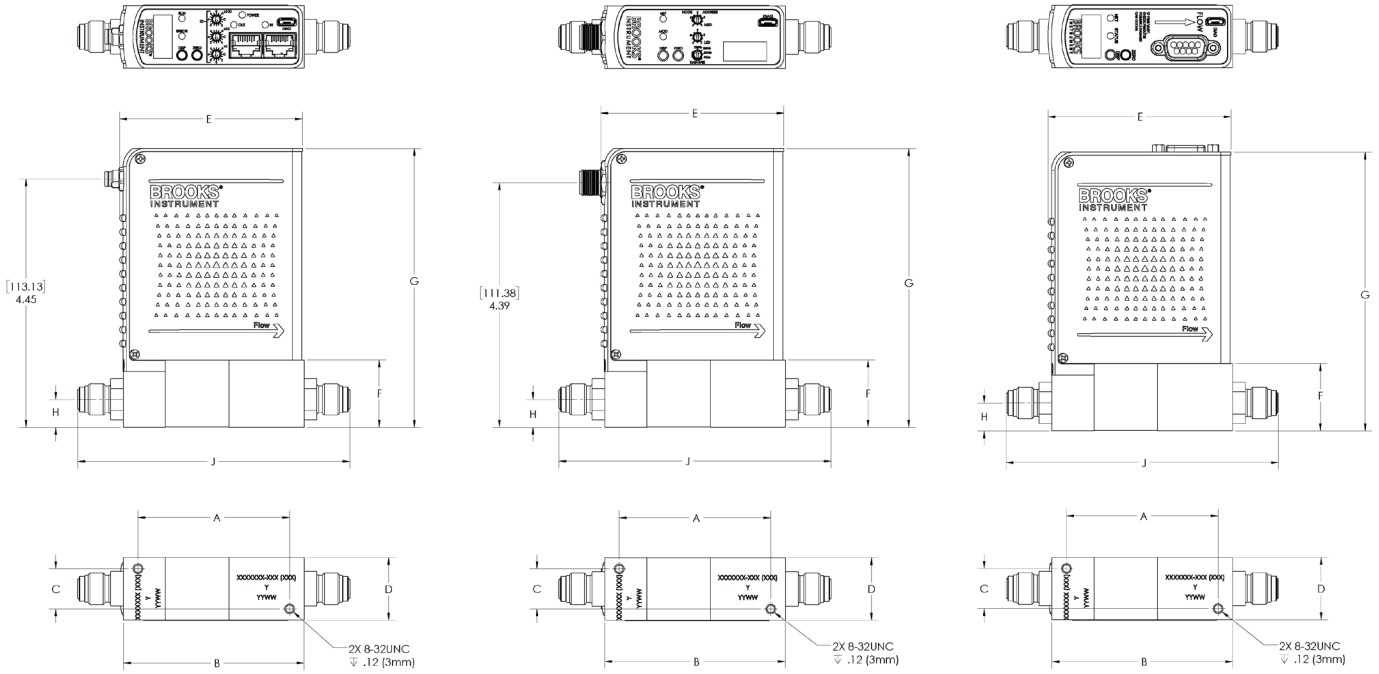

POKE YOKE CONFIGURATION

| Fitting Option Code | Seal Type | Dim A | Dim B | Dim C | Dim D | Dim E | Dim F | Dim G |
|---|---|---|---|---|---|---|---|---|
| CX | C-SEAL | 92mm [3.62in] | 105mm [4.13in] | 22mm [0.86in] | 28mm [1.12in] | 83mm [3.28in] | 25mm [1.00in] | 127mm [5.00in] |
| WX | W-SEAL | 92mm [3.62in] | 105mm [4.13in] | 22mm [0.86in] | 28mm [1.12in] | 83mm [3.28in] | 25mm [1.00in] | 127mm [5.00in] |
| LX | C-SEAL | 92mm [3.62in] | 105mm [4.13in] | 22mm [0.86in] | 28mm [1.12in] | 83mm [3.28in] | 25mm [1.00in] | 127mm [5.00in] |

# Product Dimensions

## GP200 Series - VCR Configurations

ELECTRICAL CONNECTOR
E0 SPECIFIC DIMENSIONS




ELECTRICAL CONNECTOR
DX, DO-DE SPECIFIC DIMENSIONS




ELECTRICAL CONNECTOR
G1/TX SPECIFIC DIMENSIONS




| Fitting Option Code | VCR | Dim A | Dim B | Dim C | Dim D | Dim E | Dim F | Dim G | Dim H | Dim I |
|---|---|---|---|---|---|---|---|---|---|---|
| VS | 1/4" | 69mm [2.72in] | 82mm [3.24in] | 18mm [0.72in] | 28.4mm [1.12in] | 83mm [3.28in] | 31mm [1.21in] | 127mm [5.00in] | 13mm [0.50in] | 124mm [4.88in] |

# Model Code

| Code Description | Code Option | Option Description |
|---|---|---|
| I. Base Model Code | GP200 | Ultra-High Purity Pressure-Based Mass Flow Controllers |
| II. Valve Configuration | P | Positive Shut-off/Zero Leak-by Valve[6] |
| | C | Normally Closed Valve with Metal Valve Seat |
| III. Gas and Range[7] | 0013 010C | 10 sccm F.S. $N_2$ Equivalent, CT40 Standard Bin Configuration at 35 psia inlet, vacuum outlet |
| | 0013 030C | 30 sccm F.S. $N_2$ Equivalent, CT41 Standard Bin Configuration at 35 psia inlet, vacuum outlet |
| | 0013 100C | 100 sccm F.S. $N_2$ Equivalent, CT42 Standard Bin Configuration at 35 psia inlet, vacuum outlet |
| | 0013 300C | 300 sccm F.S. $N_2$ Equivalent, CT43 Standard Bin Configuration at 35 psia inlet, vacuum outlet |
| | 0013 001L | 1,000 sccm F.S. $N_2$ Equivalent, CT44 Standard Bin Configuration at 35 psia inlet, vacuum outlet |
| | 0013 003L | 3,000 sccm F.S. $N_2$ Equivalent, CT45 Standard Bin Configuration at 35 psia inlet, vacuum outlet |
| | 0013 010L | 10,000 sccm F.S. $N_2$ Equivalent, CT46, Standard Bin Configuration at 35 psia inlet, vacuum outlet |
| | 0013 025L | 25,000 sccm F.S. $N_2$ Equivalent, CT47 Standard Bin Configuration at 35 psia inlet, vacuum outlet |
| | 0013 045L | 45,000 sccm F.S. $N_2$ Equivalent, CT48 Standard Bin Configuration at 35 psia inlet, vacuum outlet |

| IV. Bin Configuration Type[7] | Option | Bin Type | Bin Configuration |
|---|---|---|---|
| | CT40 | Standard Type (CT) Bin | Standard Bin Configuration #40 |
| | CT41 | | Standard Bin Configuration #41 |
| | CT42 | | Standard Bin Configuration #42 |
| | CT43 | | Standard Bin Configuration #43 |
| | CT44 | | Standard Bin Configuration #44 |
| | CT45 | | Standard Bin Configuration #45 |
| | CT46 | | Standard Bin Configuration #46 |
| | CT47 | | Standard Bin Configuration #47 |
| | CT48 | | Standard Bin Configuration #48 |
| | LP40 | Low Pressure (LP) Bin | Low Pressure Bin Configuration #40 |
| | LP41 | | Low Pressure Bin Configuration #41 |
| | LP42 | | Low Pressure Bin Configuration #42 |
| | LP43 | | Low Pressure Bin Configuration #43 |
| | LP44 | | Low Pressure Bin Configuration #44 |
| | LP45 | | Low Pressure Bin Configuration #45 |
| | LP46 | | Low Pressure Bin Configuration #46 |

| V. Fitting | CX | 1-1/8” body width, 92mm C Seal |
|---|---|---|
| | WX | 1-1/8” body width, 92mm W Seal |
| | VS | 1-1/8" body width, 124mm 1/4" VCR male |
| | LX | 1-1/8” body width, 92mm C Seal w/Poke Yoke |

[6] Zero Leak Valve Option not currently available with bins CT47-CT48

[7] Consult Brooks Configurator or Bin Tables for specific Product Sizing Options

# Model Code

| Code Description | Code Option | Option Description | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| VI. Communications/Connector | E0 | EtherCAT Communication | | | | | | | | |
| | G1 | 9-Pin D-Connector with Analog/RS485 Communication | | | | | | | | |
| | TX | 9-Pin D-Connector with Analog Only | | | | | | | | |
| | **Option** | **I/O** | **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 | DeviceNet | Idle | Count | Integer | 6000h | 2 | 7 | Executing | 500KB |
| | D1 | DeviceNet | Idle | Count | Integer | 6000h | 21 | 7 | Executing | 500KB |
| | D2 | DeviceNet | Idle | SCCM | Float | 7FFFh | 13 | 19 | Executing | 500KB |
| | D3 | DeviceNet | Idle | Count | Integer | 6000h | 22 | 7 | Executing | 500KB |
| | D4 | DeviceNet | Executing | Count | Integer | 6000h | 22 | 8 | Executing | 500KB |
| | D5 | DeviceNet | Idle | Count | Integer | 6000h | 6 | 8 | Executing | 500KB |
| | D6 | DeviceNet | Idle | Count | Integer | 7FFFh | 3 | 7 | Executing | 500KB |
| | D7 | DeviceNet | Idle | Count | Integer | 7FFFh | 6 | 8 | Executing | 500KB |
| | D8 | DeviceNet | Idle | Count | Integer | 6000h | 3 | 7 | Executing | 500KB |
| | D9 | DeviceNet | Executing | Count | Integer | 6000h | 2 | 7 | Executing | 500KB |
| | DA | DeviceNet | Idle | Count | Integer | 7FFFh | 22 | 7 | Executing | 500KB |
| | DB | DeviceNet | Idle | Count | Integer | 6000h | 22 | 8 | Executing | 500KB |
| | DC | DeviceNet | Idle | Count | Integer | 7FFFh | 3 | 7 | Idle | 500KB |
| | DD | DeviceNet | Executing | Count | Integer | 7FFFh | 22 | 8 | Executing | 500KB |
| | DE | DeviceNet | Executing | SCCM | Float | 6000h | 15 | 19 | Executing | 500KB |
| | DX | To be defined by Customer Special Request | | | | | | | | |
| VII. Customer Special Request | XXXX | Customer Special Request (Consult factory for new requests) | | | | | | | | |
| VIII. Minimum Inlet Pressure[7] | 15 | 15 psia minimum inlet pressure, ~15-30 psia inlet pressure range | | | | | | | | |
| | 25 | 25 psia minimum inlet pressure, ~25-40 psia inlet pressure range | | | | | | | | |
| | 35 | 35 psia minimum inlet pressure, ~35-50 psia inlet pressure range | | | | | | | | |
| | 45 | 45 psia minimum inlet pressure, ~45-60 psia inlet pressure range | | | | | | | | |
| IX. Downstream Condition | V | Vacuum | | | | | | | | |
| | A | Atmosphere | | | | | | | | |
| | P | Positive Pressure (760 Torr up to 1200 Torr) | | | | | | | | |
| X. Auto Shut-off | A | Auto Shut Off (Included) | | | | | | | | |
| | X | Auto Shut Off (Not Included) | | | | | | | | |
| XI. Reference Temperature | 00C | 0°C Reference Calibration (Standard) | | | | | | | | |

Sample Model Code

| I | II | III | IV | V | VI | VII | VIII | IX | X | XI |
|---|---|---|---|---|---|---|---|---|---|---|
| GP200 | C | 0013003L | CT45 | CX | E0 | XXXX | 35 | V | A | 00C |

# Service and Support

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

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

## START-UP SERVICE AND IN-SITU CALIBRATION

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

## SEMINARS AND TRAINING

Brooks Instrument can provide customer seminars and dedicated training to engineers, end users, and maintenance persons. Please contact your nearest sales representative for more details. Due to Brooks Instrument's commitment to continuous improvement of our products, all specifications are subject to change without notice.



Data-Sheet-GP200-EN/2024-10

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