



Model 4850

# 48xx Series

## Thermal Mass Flow

## Ultra-Fast Responding Mass Flow Controllers & Meters

### Overview

The Brooks 48xx Series features a broad flow range, compact size, a variety of analog and digital I/O options, a MEMS-based sensor that provides lightning fast response times, and many other benefits for a variety of applications. The 48xx Series of mass flow controllers and mass flow meters is fully RoHS compliant and is an excellent choice for measurement and control of many common gases including air,  $N_2$ ,  $O_2$ , Ar, He,  $H_2$ ,  $CO_2$ , CO,  $N_2O$ ,  $CH_4$ ,  $C_3H_6$  (Propene), and  $C_3H_8$ . The optional Local Operator Interface (LOI) provides a convenient user interface to view, control, and configure the 48xx Series devices eliminating the need for remote secondary electronics.

### Product Description

**The 48xx Series MEMS-based sensor provides lightning fast response times.**

The 48xx Series utilizes a Micro Electro Mechanical System (MEMS) based thermal sensor. Similar to typical thermal sensors, it measures a change in temperature to determine mass flow rate. The difference is that gas flows directly across the sensor, achieving extremely fast response times.

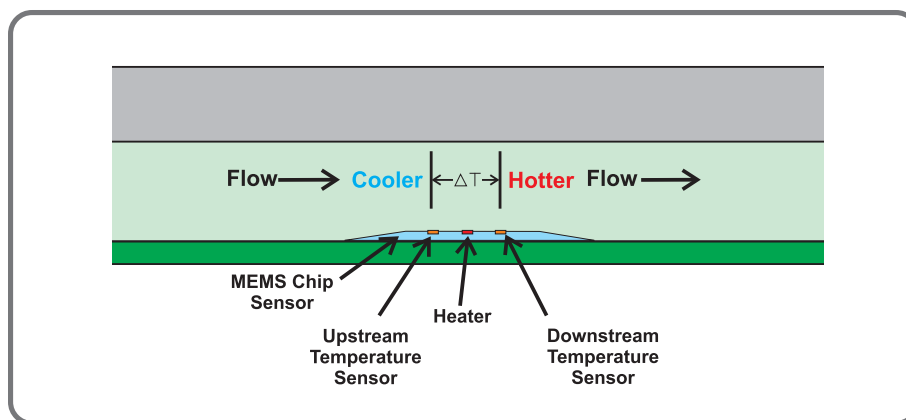


Figure 1 Gas Flow Across the MEMS Sensor

## Product Description (Continued)

### Fast settling times and stable control come standard with the 4850 controller.

The Model 4850 controller uses a proprietary PID algorithm to optimize the control valve response to ensure rapid settling times. The 4850 controller can be counted on to quickly match actual mass flow to any changes in setpoint.

### Good things come in small packages.

The MEMS sensor enables a dramatic reduction in size compared to traditional thermal mass flow controllers and thermal mass flow meters. In fact the compact size of the 48xx Series 1" x 3" x 4" (25mm x 76mm x 101mm) takes up less than half the space of typical thermal mass flow controllers.

### The 48xx Series is ideal for OEMs.

The broad flow range, fast response time and compact size make for a perfect fit in any OEM system where gas flow needs to be measured or controlled. You can download a free LabView VI to monitor and zero the device.

### The Local Operator Interface (LOI) simplifies set-up and operation.

The LOI mounts securely on top of the 48xx Series device. With status LEDs and a large backlit LCD it provides a convenient user interface to view, control and configure the Brooks 48xx Series thermal mass flow devices. This option also allows the user to power the device with a simple power adapter that plugs right in to the wall.

### RoHS compliant

Fully RoHS compliant per EU Directive 2011/65/EU.

### Variety of input/output options.

The 48xx Series thermal mass flow controllers and thermal mass flow meters come standard with voltage or current and RS232 I/O.

### Easily integrated into modular gas delivery systems

The 48xx Series is available with downport connections making it easy to integrate into modular gas delivery systems.

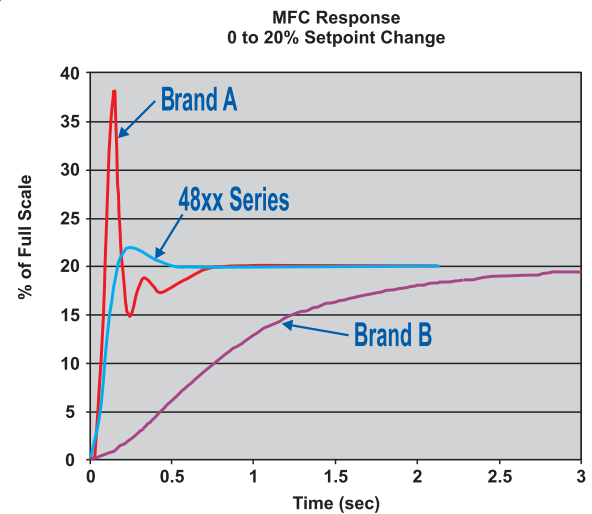


Figure 2 Fast Settling Time

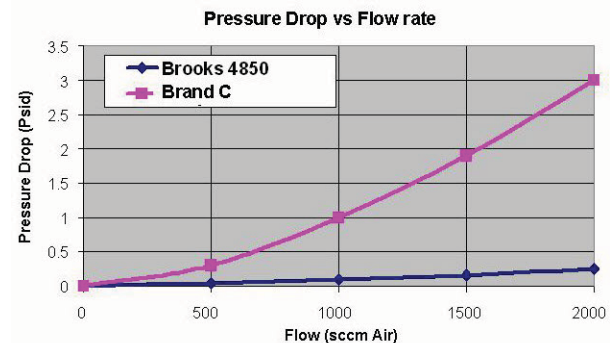


Figure 3 Low Pressure Drop

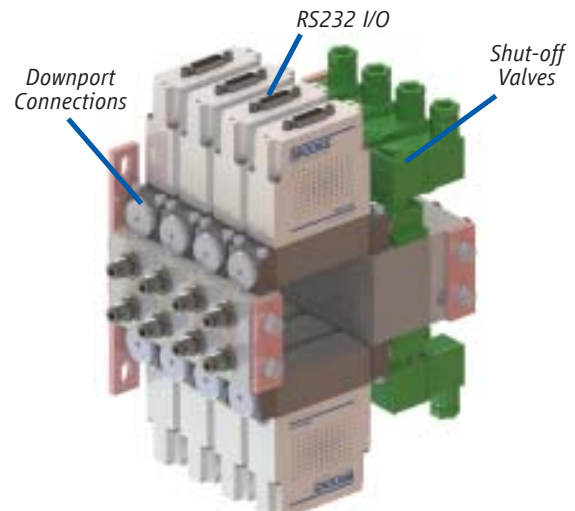


Figure 4 Modular Gas Delivery System

## Features and Benefits



Figure 5 48xx Series with Local Operator Interface

| Features                                | Benefits   |
|---|--|
| Fast response time                      | Ensure rapid step during process recipe changes  |
| Compact size                            | Reduces space and eases installation   |
| Optional Local Operator Interface (LOI) | Provides a turnkey solution for local indication, set point control and device configuration eliminating the need for remote secondary electronics |
| Low pressure drop across the sensor     | Provide flow measurement with minimal pressure budget  |
| Variety of analog and digital I/O       | Easily aligns with user requirements   |
| Fully RoHS compliant                    | Meets emerging environmental requirements  |

## Product Specifications

### Performance

|                                |   |
|--------------------------------|---|
| <b>Full Scale Flow Range</b>   | 50 ml/min - 40 l/min<br>(50 sccm - 40 slpm)<br>(N <sub>2</sub> eq., at 0°C Ref, with typical 50 psid pressure differential) |
| <b>Control Range</b>           | 2 - 100%  |
| <b>Flow Accuracy</b>           | +/- 3.0% of FS, +/- 1.0% FS optional  |
| <b>Flow Repeatability</b>      | +/- 0.15% of FS   |
| <b>Response Time</b>           | Flow signal: <0.3 sec<br>Flow control: Settling time <0.75 sec from 0 to 100% FS (typical <0.5 sec for all steps)           |
| <b>Temperature Coefficient</b> | +/- 0.1% of FS/°C (N <sub>2</sub> )   |

### Ratings

|  |   |
|--|---|
| <b>Gases</b>                                     | Air, N <sub>2</sub> , O <sub>2</sub> , Ar, He, H <sub>2</sub> , CO <sub>2</sub> , CO, N <sub>2</sub> O, CH <sub>4</sub> , C <sub>3</sub> H <sub>6</sub> (Propene), C <sub>3</sub> H <sub>8</sub> (other gases upon request) |
| <b>Operating Limits</b>                          | Pressure 0 - 10 barg (0 - 150 psig)<br>Temperature 0 - 50°C<br>Humidity 5 to 95% R.H. (ambient)   |
| <b>Differential Pressure Range (Controllers)</b> | Minimum: 0.35 bar (5 psid)<br>Maximum: 10 bar (150 psid)  |
| <b>Leak Integrity</b>                            | Inboard to Outboard: 1x10 <sup>-9</sup> atm scc/sec Helium max.   |

### Mechanical

|                                  |  |
|----------------------------------|--|
| <b>Materials of Construction</b> | Wetted parts: stainless steel, fluoroelastomers, silicon-based sensor                              |
| <b>RoHS</b>                      | Fully RoHS compliant per EU Directive 2011/65/EU   |
| <b>Outline Dimensions</b>        | Refer to Figures 6 and 7   |
| <b>Process Connections</b>       | Inlet/Outlet threads: 9/16" - 18 UNF threads, Refer to Figure 6 for available process connections. |

### Electrical

|                        |  |            |              |          |              |          |
|------------------------|--|------------|--------------|----------|--------------|----------|
| Electrical Connections | 15-pin D-sub connector<br>Analog/RS232: 15-pin D-sub connector   |            |              |          |              |          |
| Power Supply Voltage** | +15 Vdc + 10% or<br>+24 Vdc + 10%<br>Device only uses single sided power supply<br>Inrush current: < 1 A |            |              |          |              |          |
| Power Requirements     | Model  | Device     | 15 Vdc       |          | 24 Vdc       |          |
|                        |  | Type       | Typical (mA) | Max (mA) | Typical (mA) | Max (mA) |
|                        | 4850   | Controller | 130          | 160      | 150          | 200      |
|                        | 4860   | Meter      | 30           | 60       | 30           | 60       |
| Analog Input/Output    | 0-5 Vdc or 4-20 mA   |            |              |          |              |          |
| Digital Input/Output   | RS232 (Standard with all analog I/O options)   |            |              |          |              |          |
| Valve Override Signal  | Valve Controller: Input Open<br>Valve Closed: <0.3 V; open valve: >4.8 V                                 |            |              |          |              |          |

\*\* For high flows and/or low differential pressures (using orifices 0.049" (1.25mm) or 0.079" (2.0mm)) only 24 Vdc power is available.

### Local Operator Interface (LOI)

|                                  |  |
|----------------------------------|--|
| <b>Display</b>                   | Effective display area: 28mm wide, 11mm high<br>Display Contents: 8x2 dot matrix display   |
| <b>Operating Limits</b>          | Temperature 0-50°C<br>Operating Humidity 5 to 95% R.H. (ambient)   |
| <b>Electrical Connections</b>    | 2 15-pin D-sub connectors, one for the connection to the 48xx Series and one for the remote connection   |
| <b>Power Supply Voltage</b>      | The LOI optionally includes a wall mount power adaptor with a 3.5-mm DC-plug. The adaptor works with input voltages of AC 90-240 V/47-63Hz. The adaptor supports European, U.K., Australia and U.S. wall plugs. Power can also be supplied by a remote connection via the D-connector. |
| <b>Materials of Construction</b> | Enclosure: ABS plastic with CU-Ni plating  |
| <b>RoHS</b>                      | Fully RoHS compliant per EU Directive 2011/65/EU.  |
| <b>Outline Dimensions</b>        | Refer to Figure 8  |

## Product Dimensions - 48xx Standard Process and Downport Connections

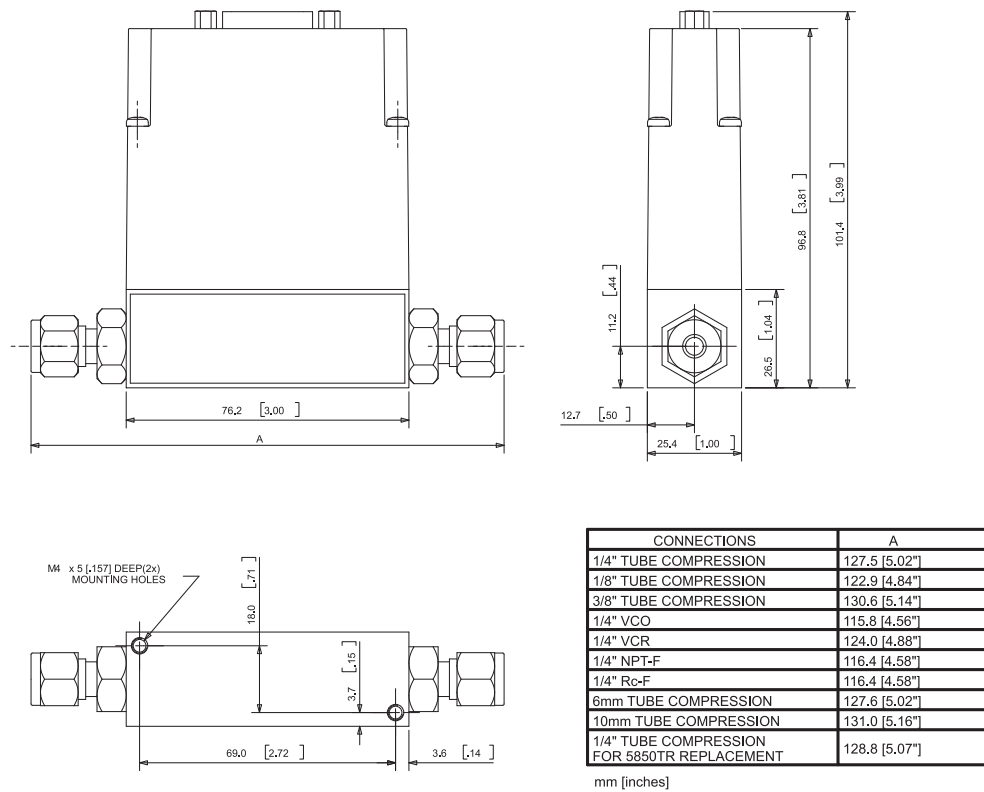


Figure 6 Dimensions for 48xx Series Devices with Standard Process Connections

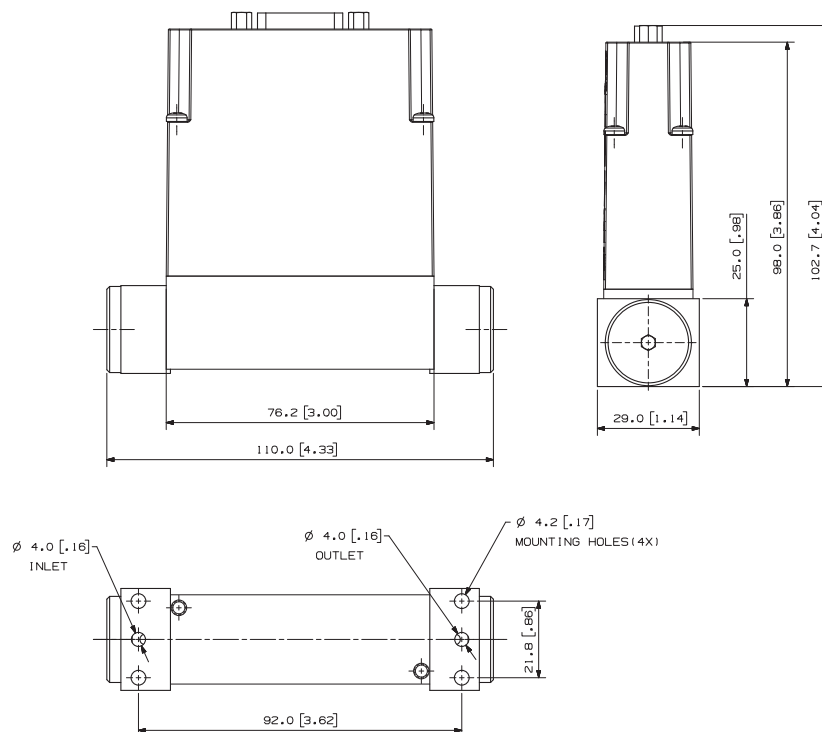


Figure 7 Dimensions for 48xx Series Devices with Downport Connections

## Product Dimensions - LOI Module

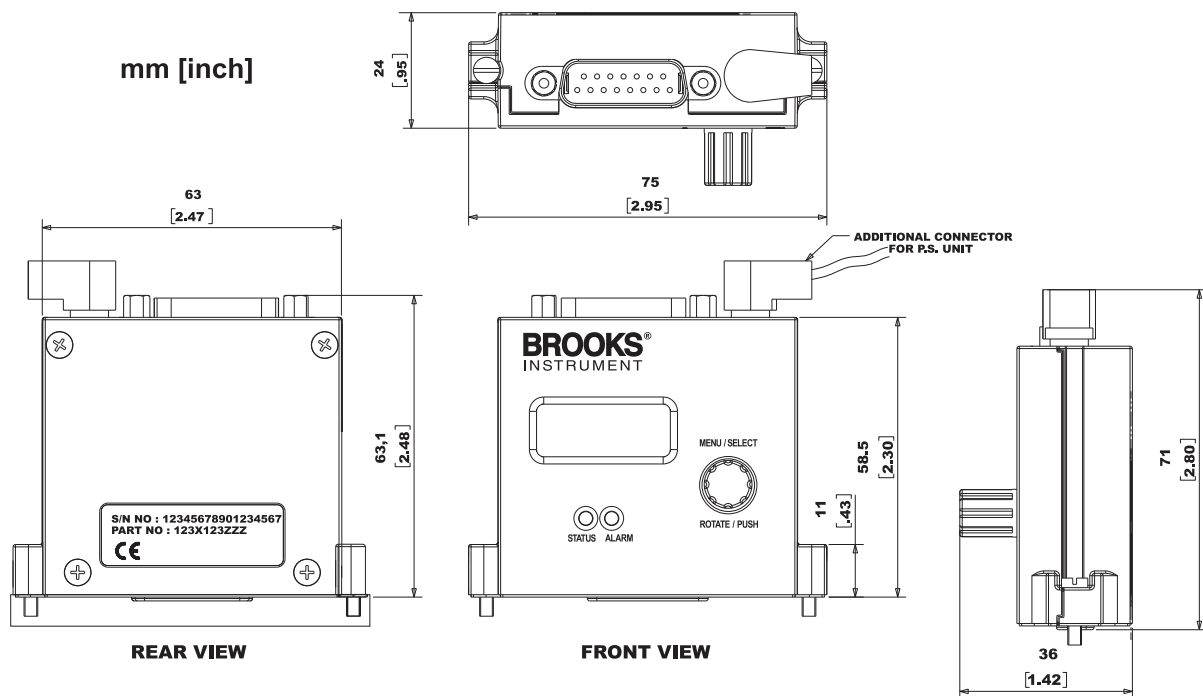
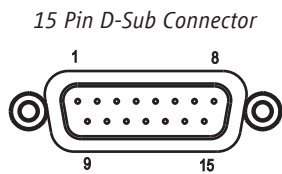


Figure 8 Dimensions for 48xx Series LOI Module




Table 1 48xx Series Pin-Out Diagram



| PIN# | 4800 Series / LOI       |
|------|-------------------------|
| 1    | Setpoint Signal Common  |
| 2    | Flow Voltage Output     |
| 3    | Not used                |
| 4    | Flow Current Output     |
| 5    | Positive Supply Voltage |
| 6    | Not used                |
| 7    | Setpoint Current Input  |
| 8    | Setpoint Voltage Input  |
| 9    | Power Supply Common     |
| 10   | Flow Signal Common      |
| 11   | Not used                |
| 12   | Valve Override Input    |
| 13   | Not used                |
| 14   | RXD                     |
| 15   | TXD                     |

## Product Certifications

These certifications cover the 48xx Series thermal mass flow devices as well as the Local Operator Interface (LOI).

| Mark  | Agency | Certification/ Marking/ Directive   | Applicable Standard                | Details                          |
|---|--------|---|------------------------------------|----------------------------------|
|  | CSA    | Class I, Div 2 Groups A, B, C & D; T4<br>Class 1, Zone 2, AEx nA II T4<br>Ex nA II T4 | UL & CSA Standards                 | Certificate No.<br>06.CSA150464  |
|  | ATEX   | II 3 G Ex nA II T4  | EN60079-0:2006<br>EN 60079-15:2005 | KEMA 06ATEX0251 X                |
|  | CE     | EMC Directive<br>2014/30/EU   | EN:61326-1:2013                    | EMC                              |
|   |        | RoHS Directive<br>2011/65/EU  |                                    | RoHS                             |
|   |        | Pressure Equipment Directive<br>2014/68/EU  |                                    | Sound Engineering Practice (SEP) |

### Hazardous Location Classification

The modules shall be installed in a suitable enclosure providing a degree of protection of at least IP54 according to EN 60529, taking into account the environmental conditions under which the equipment will be used. Provisions shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 40%.

## Model Code

| Code Description |                            | Code Option | Option Description  |             |                   |                   |
|------------------|----------------------------|-------------|---|-------------|-------------------|-------------------|
| I.               | Base Model Number          | 4850        | Flow Controller, Body 0 (50 sccm-40 slpm)                                   |             |                   |                   |
|                  |                            | 4860        | Flow Meter, Body 0 (50 sccm-40 slpm)  |             |                   |                   |
| II.              |                            | A           | RS-232 + Analog, Select applicable analog I/O                               |             |                   |                   |
| III.             |                            | B           | Revision  |             |                   |                   |
| IV.              | Analog I/O, Input / Output | B           | 0-5 Vdc / 0-5 Vdc   |             |                   |                   |
|                  |                            | C           | 4-20 mA / 4-20 mA   |             |                   |                   |
|                  |                            | D           | 0-5 Vdc / 4-20 mA   |             |                   |                   |
|                  |                            | E           | 4-20 mA / 0-5 Vdc   |             |                   |                   |
|                  |                            | 0           | None  |             |                   |                   |
| V.               | Power Supply               | 1           | 15 Vdc  |             |                   |                   |
|                  |                            | 2           | 24 Vdc  |             |                   |                   |
| VI.              | Mechanical Connections     | 1A          | 9/16" -18unf straight thread  |             |                   |                   |
|                  |                            | B1          | 1/4" tube compression w/filter  |             |                   |                   |
|                  |                            | C1          | 1/8" tube compression w/filter  |             |                   |                   |
|                  |                            | D1          | 3/8" tube compression w/filter  |             |                   |                   |
|                  |                            | E1          | 1/4" VCR w/filter   |             |                   |                   |
|                  |                            | F1          | 1/4" VCO w/filter   |             |                   |                   |
|                  |                            | G1          | 1/4' NPT-F w/filter   |             |                   |                   |
|                  |                            | H1          | 6mm tube compression w/filter   |             |                   |                   |
|                  |                            | J1          | 10mm tube compression w/filter  |             |                   |                   |
|                  |                            | S1          | Downport, no O-ring cavity  |             |                   |                   |
|                  |                            | T1          | 1/4" Rc (BSPT) w/filter   |             |                   |                   |
|                  |                            | X1          | Downport, with O-ring cavity  |             |                   |                   |
|                  |                            | Y1          | 1/4" tube w/filter (5850TR replace)   |             |                   |                   |
| VII.             | Body                       |             | Body  | O-Ring Seal | Seat              | Valve Type        |
|                  |                            | A           | 316ss   | Viton       | None (Meter Only) | None (Meter Only) |
|                  |                            | B           | 316ss   | Viton       | Viton             | Normally Closed   |
| VIII.            | Area Classification        | 1           | Standard Location (Safe Area)   |             |                   |                   |
|                  |                            | 2           | ATEX Zone 2   |             |                   |                   |
|                  |                            | 4           | CSA Div 2/Zone 2 (Recognized)   |             |                   |                   |
| IX.              | Valve Orifice Size         | A           | No Orifice (Meter Only)   |             |                   |                   |
|                  |                            | B           | 0.001 inch / 0.03mm   |             |                   |                   |
|                  |                            | C           | 0.002 inch / 0.05mm   |             |                   |                   |
|                  |                            | D           | 0.003 inch / 0.08mm   |             |                   |                   |
|                  |                            | E           | 0.005 inch / 0.125mm  |             |                   |                   |
|                  |                            | F           | 0.008 inch / 0.2mm  |             |                   |                   |
|                  |                            | G           | 0.012 inch / 0.315mm  |             |                   |                   |
|                  |                            | H           | 0.020 inch / 0.5mm  |             |                   |                   |
|                  |                            | J           | 0.031 inch / 0.8mm  |             |                   |                   |
|                  |                            | K           | 0.049 inch / 1.25mm only available with power supply option code=2 (24 Vdc) |             |                   |                   |
|                  |                            | M           | 0.079 inch / 2.0mm only available with power supply option code=2 (24 Vdc)  |             |                   |                   |

Model Code continued on next page.



## Model Code (Continued)

| Code Description                    | Code Option | Option Description  |   |                    |
|-------------------------------------|-------------|---|---|--------------------|
| <b>X.</b> Mass Flow Restrictor Type |             | <b>Type or Restrictor</b>   | <b>Restrictor Range (sccm N<sub>2</sub> Equivalent @ 0 Deg C ref)</b> |                    |
|                                     | <b>A</b>    | No Restrictor   | NA  | NA                 |
|                                     | <b>C</b>    | Plug  | 0   | 180                |
|                                     | <b>K</b>    | K   | 160.4   | 228.53             |
|                                     | <b>M</b>    | M   | 218.4   | 310.6              |
|                                     | <b>N</b>    | N   | 265.7   | 377.7              |
|                                     | <b>P</b>    | P   | 332   | 471.6              |
|                                     | <b>Q</b>    | Q   | 424.8   | 603                |
|                                     | <b>R</b>    | R   | 554.8   | 787                |
|                                     | <b>S</b>    | S   | 736.7   | 1044.6             |
|                                     | <b>T</b>    | T   | 991.4   | 1405               |
|                                     | <b>U</b>    | U   | 1348  | 1910               |
|                                     | <b>V</b>    | V   | 1847  | 2617               |
|                                     | <b>W</b>    | W   | 2546  | 3607               |
|                                     | <b>X</b>    | X   | 3524  | 4992               |
|                                     | <b>Y</b>    | Y   | 4894  | 6932               |
|                                     | <b>1</b>    | 1   | 6811  | 9647               |
|                                     | <b>2</b>    | 2   | 9496  | 13,453             |
|                                     | <b>3</b>    | 3   | 13,250  | 18,773             |
|                                     | <b>4</b>    | 4   | 18,520  | 30,143             |
|                                     | <b>5</b>    | 5   | 30,100  | 50,143             |
| <b>XI.</b> Calibration              |             | <b>Calibration Condition</b>  | <b>Accuracy</b>   | <b>Tracability</b> |
|                                     | <b>A</b>    | None-Uncalibrated   | NA  | NA                 |
|                                     | <b>B</b>    | Single Gas  | +/- 3.0% of FS  | None               |
|                                     | <b>C</b>    | Single Gas  | +/- 1.0% of FS  | None               |
|                                     | <b>D</b>    | Single Gas  | +/- 1.0% of FS  | NIST               |
|                                     | <b>E</b>    | Single Gas  | +/- 1.0% of FS  | CMC Cert. (NMI)    |
| <b>XII.</b> Accessories             | <b>0</b>    | None  |   |                    |
|                                     | <b>1</b>    | LOI with Power Adapter  |   |                    |
|                                     | <b>2</b>    | LOI without Power Adapter   |   |                    |
| <b>XIII.</b> Certificates           | <b>0</b>    | None  |   |                    |
|                                     | <b>9</b>    | Multiple Certs. Describe required certs in notes. Add all applicable changes to list price. |   |                    |
|                                     | <b>A</b>    | Declaration of Compliance 2.1 (Certificate of Conformance)                                  |   |                    |
|                                     | <b>B</b>    | Declaration of Compliance 2.1 Leak Test   |   |                    |
|                                     | <b>C</b>    | Declaration of Compliance 2.1 Pressure Test   |   |                    |
|                                     | <b>D</b>    | Declaration of Compliance 2.1 Oxygen Service  |   |                    |
|                                     | <b>E</b>    | Declaration of Compliance 2.1 Materials   |   |                    |
| <b>XIV.</b> OEM Code                | <b>A</b>    | Standard Brooks Label   |   |                    |

### Sample Model Code

| I    | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | XIII | XIV |
|------|----|-----|----|---|----|-----|------|----|---|----|-----|------|-----|
| 4850 | A  | B   | B  | 1 | 1A | A   | 2    | D  | K | E  | 2   | 9    | A   |

## 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.

### CUSTOMER SEMINARS AND TRAINING

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

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

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

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