Micro Motion™ G-Series Flow and Density Meters

VIEW PRODUCT >

Exceptional reliability and safety

- No moving parts to wear or replace minimizes maintenance for long-term reliability
- Laser-etched tagging for longevity in challenging environments
- Cleanable, self-draining design

Connectivity

- Full range of Micro Motion transmitter options and communication protocols
- Reduced wiring complexity with innovative Wi-Fi, Bluetooth®, 2-wire loop powered and Power over Ethernet solutions
- Advanced diagnostics including Smart Meter Verification

Ease of Use

- Ultra-compact, lightweight sensor design enables installation flexibility
- Easy installation, integration, and remote monitoring with trusted Micro Motion electronics
- Streamlined sensor options and pre-selected solutions for ease of ordering

Measurement principles

As a practical application of the Coriolis effect, the Coriolis mass flow meter operating principle involves inducing a vibration of the flow tube through which the fluid passes. The vibration, though it is not completely circular, provides the rotating reference frame which gives rise to the Coriolis effect. While specific methods vary according to the design of the flow meter, sensors monitor and analyze changes in frequency, phase shift, and amplitude of the vibrating flow tubes. The changes observed represent the mass flow rate and density of the fluid.

Density measurement

The measuring tubes are vibrated at their natural frequency.

A change in the mass of the fluid contained inside the tubes causes a corresponding change to the tube's natural frequency. The frequency change of the tube is used to calculate density.

Temperature measurement

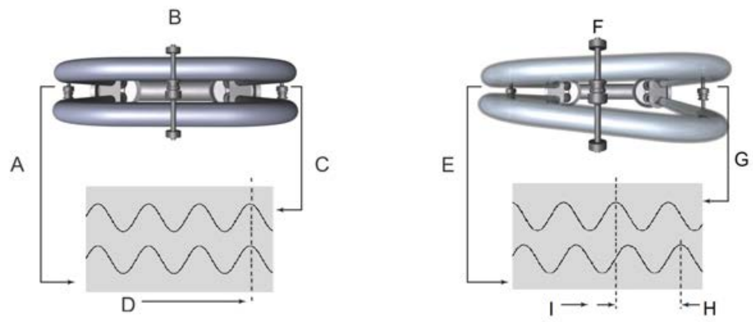
Temperature is a measured variable that is available as an output. The temperature is also used internally in the sensor to compensate for temperature influences on Young’s Modulus of Elasticity.

Mass and volume flow measurement

The measuring tubes are forced to oscillate producing a sine wave. At zero flow, the two tubes vibrate in phase with each other. When flow is introduced, the Coriolis forces cause the tubes to twist resulting in a phase shift. The time difference between the waves is measured and is directly proportional to the mass flow rate. Volume flow rate is calculated from mass flow rate and the density measurement.

Watch this video to learn more about how a Coriolis flow meter measures mass flow and density (click the link and select **View Videos**): https://www.emerson.com/en-us/automation/measurement-instrumentation/flow-measurement/coriolis-flow-meters.

Contents



A. Inlet pick off displacement
B. No flow
C. Outlet pick off displacement
D. Time
E. Inlet pick off displacement
F. With flow
G. Outlet pick off displacement
H. Time difference
I. Time

Meter characteristics

- Measurement accuracy is a function of fluid mass flow rate independent of operating temperature, pressure, or composition. However, pressure drop through the sensor is dependent upon operating temperature, pressure, and fluid composition.
- Specifications and capabilities vary by model and certain models may have fewer available options. For detailed information regarding performance and capabilities, either contact customer service or visit .

Performance specifications

Reference operating conditions

For determining the performance capabilities of our meters, the following conditions were observed / utilized:

- Water at 68 °F (20 °C) to 77 °F (25 °C) and 14.5 psig (1 barg) to 29 psig (2 barg), installed in a tubes-down orientation
- Air and natural gas at 68 °F (20 °C) to 77 °F (25 °C) and 500 psig (34 barg) to 1,450 psig (100 barg), installed in a tubes-up orientation
- Accuracy based on industry leading accredited calibration standards according to ISO 17025/IEC 17025
- A density range up to 3,000 kg/m^3 (3 g/cm^3) on all models

Accuracy and repeatability

Accuracy and repeatability on liquids and slurries

Performance specifications	Enhanced	Intermediate	Basic
Mass and volume flow accuracy(1)	±0.1% of rate	±0.15% of rate	±0.25% of rate
Mass and volume repeatability	0.05% of rate	0.075% of rate	0.125% of rate
Density accuracy(2)	±5.00 kg/m^3 (±0.005 g/cm^3)		
Density repeatability	±2.5 kg/m^3 (±0.0025 g/cm^3)		

(1) *Stated flow accuracy includes the combined effects of repeatability, linearity, hysteresis. orientation, and other non-linearities.*
(2) *Liquid density uncertainty of ±0.5 kg/m^3 (±0.0005 kg/cm^3) at reference conditions.*

Accuracy and repeatability on gases

Performance specification	Standard models
Mass flow accuracy(1)	±0.5% of rate
Mass flow repeatability	0.25% of rate

(1) *Stated flow accuracy includes the combined effects of repeatability, linearity, hysteresis, orientation, and other non-linearities.*

Accuracy and repeatability on temperature

Performance specification	Standard models
Temperature accuracy	±1 °C ±0.5% of reading
Temperature repeatability	0.2 °C

Warranty

Warranty options on all G-Series models

The warranty period is generally initiated from the day of shipment. For warranty details, see the *Terms and Conditions* included with the standard product quote.

Base model	Included as standard	Included with start-up service	Available for purchase
G025 - G300	18 months	36 months	> 36 months (customizable length)

Liquid flow rates

Zero stability and minimum flow rate

Zero stability is used when the flow rate approaches the low end of the flow range where the meter accuracy begins to deviate from the stated accuracy. When operating at flow rates where the meter accuracy begins to deviate from the stated accuracy rating, accuracy is governed by the formula:

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Accuracy = (zero stability / flow rate) X 100%
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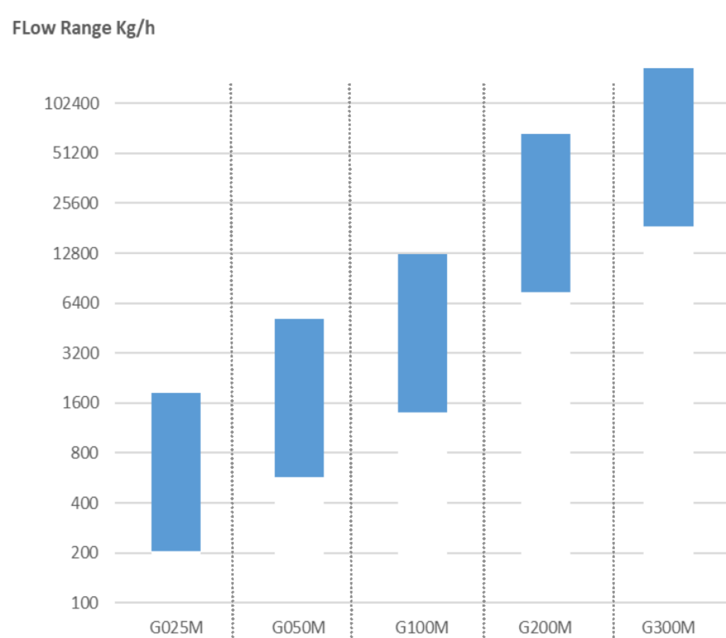
Repeatability is similarly affected by low flow conditions.

Associated minimum flow rates are defined depending on the performance specifications selected.

Nominal flow rate

Micro Motion has adopted the term nominal flow rate, which is the flow rate at which water at reference conditions causes approximately 14.5 psig (1 barg) of pressure drop across the meter. Consult the Flow Measurement Sizing and Selection Tool to evaluate maximum flow rate and pressure drop for your application.

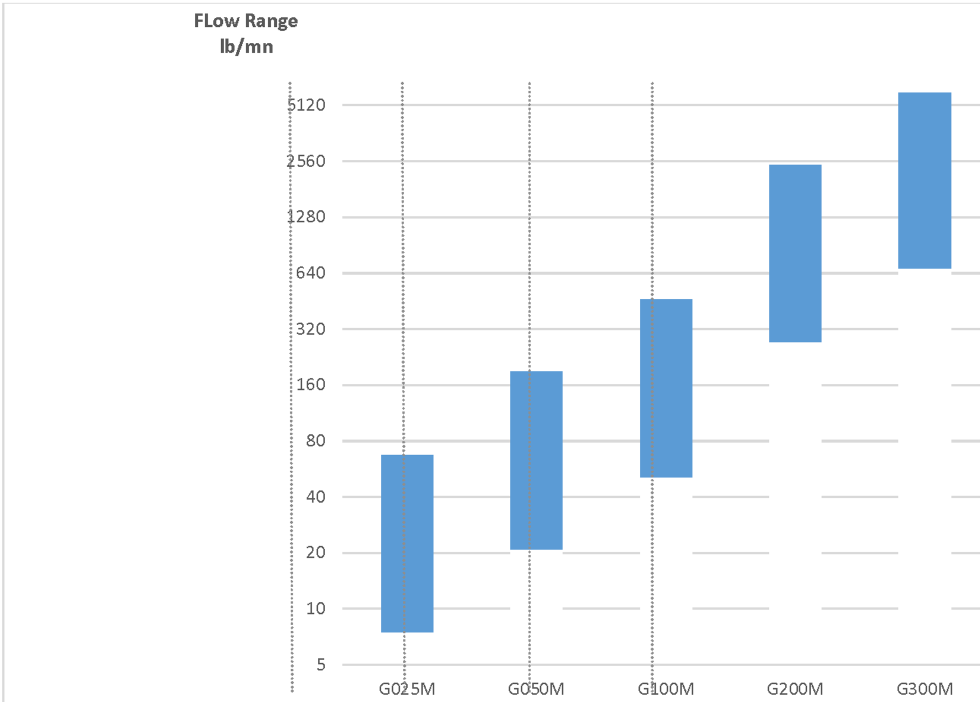
Figure 1: G-Series Flow Range and Performance Specifications: Metric



Metric

Performance Specifications		G025M	G050M	G100M	G200M	G300M
Nominal Line Size mm		DN6	DN15	DN25	DN50	DN80
Zero Stability Kg/h		0.204	0.572	1.396	7.434	18.450
Min Flow (Kg/h)	Basic 0.25% Accuracy	82	229	558	2,973	7,379
	Intermediate 0.15% Accuracy	136	381	930	4,956	12,300
	Enhanced 0.1% Accuracy	204	572	1,396	7,434	18,450
Nominal Flow kg/h		1,632	4,578	11,168	59,474	147,528

Figure 2: G-Series Flow Range and Performance Specifications: Imperial



Imperial

Performance Specifications		G025M	G050M	G100M	G200M	G300M
Nominal Line Size mm		1/4"'	½"	1"	2"	3"
Zero Stability lb/mn		0.0075	0.021	0.051	0.273	0.678
Min Flow (lb/mn)	Basic 0.25% Accuracy	3	8.4	20.5	109	271
	Intermediate 0.15% Accuracy	5	14	34	182	451
	Enhanced 0.1% Accuracy	7.5	21	51	273	678
Nominal Flow lb/mn		60	168	410	2,185	5,420

Gas flow rates

When selecting sensors for gas applications, pressure drop and turndown through the sensor is dependent upon operating temperature, pressure, and fluid composition. Therefore, when selecting a sensor for any particular gas application, it is highly recommended that each sensor be sized using the Flow Measurement Sizing and Selection Tool that will report both the actual velocity and the sonic velocity for each flow rate and meter size considered.

Use the following equation to determine general recommendations on nominal and maximum gas mass flow rates:

$$\dot{m}_{(gas)} = \%M * \rho_{(gas)} * VOS * \frac{1}{4}\pi * D^2 * 2 \text{ (for sensors with dual-tube design)}$$

$\dot{m}_{(gas)}$	Gas mass flow rate
%M	Use Mach number “0.2” for calculating maximum recommended flow rate. When Mach Numbers are above 0.3, most gas flows become compressible and significant increases in pressure drop may occur regardless of measurement device.
$\rho_{(gas)}$	Gas density at operating conditions
VOS	Velocity of sound of the measured gas
D	Internal diameter of the measuring tube

Note
Gas maximum flow rate can never be greater than the maximum liquid rate. Assume that the lower of the two rates is applicable.

Sample calculation

The following calculation is an example of the maximum recommended gas mass flow rate for a G300M measuring natural gas with a molecular weight of 19.5 at 60 °F (16 °C) and 500 psig (34.47 barg):

$$\dot{m}_{(gas)} = 0.2 * 24\ (kg/m^3) * 430\ (m/s) * \frac{1}{4}\pi * .040m^2 * 2$$

$$\dot{m}_{(gas)} = 34{,}988 \text{ kg/hr; maximum recommended rate for G300M with natural gas at given conditions}$$

%M	0.2 (used for calculating maximum recommended rate)
Gas density	24 kg/m3
$VOS_{(NG)}$	430 m/s (Velocity of Sound of natural gas at given conditions)
G300M tube ID	40 mm

Process pressure ratings

Sensor maximum working pressure reflects the highest possible pressure rating for a given sensor. Process connection type and environmental and process fluid temperatures may reduce the maximum rating.

All sensors comply with Council Directive 2014/68/EU on pressure equipment.

Process pressure ratings

Model	Pressure
G025M, G050M, G100M,G200M, G300M	1,450 psi (100 bar)

Case pressure

Case pressure for all models

Model	Case maximum pressure(1)	Typical burst pressure
G025	471 psi (32 bar)	1884 psi (130 bar)
G050	383 psi (26 bar)	1530 psi (105 bar)
G100	320 psi (22 bar)	1281 psi (88 bar)
G200	190 psi (13 bar)	760 psi (52 bar)
G300	125 psi (9 bar)	500 psi (34 bar)

(1) *Case maximum pressure is determined by applying a safety factor of 4 to typical burst pressure.*

Operating conditions: environmental

Vibration limits

Meets IEC 60068-2-6, endurance sweep, 5 to 2000 Hz up to 1.0 g.

Temperature limits

Sensors can be used in the process and ambient temperature ranges shown in the temperature limit graphs. For the purposes of selecting electronics options, temperature limit graphs should be used only as a general guide. If your process conditions are close to the gray area, consult technical support.

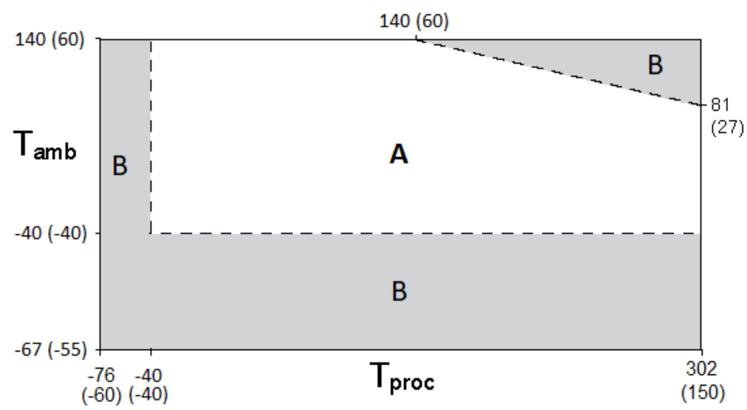
WARNING

Temperature limits may be further restricted by hazardous area approvals that are necessary to avoid potential injury to personnel and damage to equipment. Refer to the hazardous area approvals documentation shipped with the sensor for specific temperature ratings for each model and configuration.

Note

In all cases, the electronics cannot be operated where the ambient temperature is below -40 °F (-40.0 °C) or above 140 °F (60.0 °C). If a sensor is to be used where the ambient temperature is outside of the range permissible for the electronics, the electronics must be remotely located where the ambient temperature is within the permissible range, as indicated by the shaded areas of the temperature limit graphs.

Ambient and process temperature limits for all G-Series meters



T_{amb} = Ambient temperature °F (°C)
T_{proc} = Process temperature °F (°C)
A = All available electronic options
B = Remote mount electronics only

Operating conditions: process

Process temperature effect

- For mass flow measurement, process temperature effect is defined as the change in sensor flow accuracy specification due to process temperature change away from the calibration temperature. Temperature effect on flow can be corrected by zeroing at normal operating temperature. Use the Zero Verification tool to optimize the zero calibration.
- For density measurement, process temperature effect is defined as the change in density accuracy specification due to process temperature change away from the calibration temperature.

Process temperature effect for all models

Model	Mass flow	Density	
	% of nominal mass flow rate per °C	g/cm^3 per °C	kg/m^3 per °C
G025, G050, G100, G200, G300	±0.0014	±0.0003	±0.3

Process pressure effect

Process pressure effect is defined as the change in sensor mass flow and density accuracy specification due to process pressure change away from the calibration pressure. This effect can be corrected by dynamic pressure input or a fixed meter factor. See the calibration sheet for the specific meter pressure compensation coefficient. If no pressure compensation coefficient is provided, use the typical values listed in the table below. For proper setup and configuration, see the transmitter's configuration and use manual at www.emerson.com.

Process pressure effect for all models

Model	Mass flow (% of rate)		Density	
	per psi	per bar	g/cm^3 per psi	kg/m^3 per bar
G025	None	None	-0.000003	-0.041
G050	None	None	-0.000035	-0.051
G100	None	None	-0.0000145	-0.21
G200	None	None	-0.00001	-0.148
G300	-0.0014	-0.0203	-0.000005	-0.074

Viscosity range

For installations with fluid viscosities greater than 500 centistokes (cSt), consult your Emerson sales representative or technical support for guidance on optimizing your configuration.

Pressure relief

G-Series sensors are available with a rupture disk installed on the case. Rupture disks vent process fluid from the sensor case in the unlikely event of a flow tube breach. The standard rupture activation pressure is 63.8 psig (4.4 barg). For more information about rupture disks, contact customer service. For more information about rupture disks, contact customer service.

If the sensor has a rupture disk, keep it installed at all times, as it would otherwise be necessary to re-purge the case. If the rupture disk is activated by a tube breach, the seal in the rupture disk will be broken, and the Coriolis meter should be removed from service.

Figure 3: Rupture disk on the G-Series

WARNING

High-pressure fluid escaping from the sensor can cause severe injury or death

Orient the sensor so that personnel and equipment will not be exposed to any discharge along the pressure relief path.
Stay clear of the rupture disk pressure relief area.

NOTICE

When using a rupture disk, the housing can no longer assume a secondary containment function.
Keep the rupture disk installed at all times, as it would otherwise be necessary to re-purge the case.

If the rupture disk is activated by a tube breach, the seal in the rupture disk will be broken. If this happens, remove the Coriolis meter from service.

NOTICE

Removing the purge fitting, blind plug, or rupture disks compromises the Ex-i Safety Certification, the Ex-tc Safety Certification, and the IP-rating of the Coriolis meter. Any modification to the purge fitting, blind plug, or rupture disks must maintain a minimum of IP66/IP67 Ratings.

Hazardous area classifications

Note

Find the current hazardous area classifications certificates at www.emerson.com.

Scroll down to **Documents & Drawings** and click **Certificates & Approvals**.

Type	Approval or certification (typical)
Ingress Protection Rating	IP 66/67 for sensors and transmitters
EMC effects	Complies with EMC Directive 2014-30-EU per EN 61326 Industrial
	Complies with NAMUR NE 21 Edition: 2017-08-01

Industry standards

Type	Standard
Industry standards and commercial approvals	■ NAMUR: NE 80, NE 95 NE 132 ■ Pressure Equipment Directive (PED) ■ Dual Seal ■ SIL 2 and SIL 3 capable (when used with an approved Micro Motion transmitter) ■ ASME B3I.3 processing piping code

Note

- Approvals shown are for G-Series meters configured with a core processor for remote 4-wire connection to a Micro Motion transmitter.
- When a meter is ordered with hazardous area approvals, detailed information is shipped along with the product.

Connectivity

G-Series sensors are highly customizable to provide a configuration that is tailor-fit to specific applications.

For help determining which Micro Motion products are right for your application, see the Micro Motion Technical Overview and Specification Summary Product Data Sheet and other resources at www.emerson.com.

Communication and diagnostic information

Transmitter interface

- Analog and digital options, including 2-wire looped power, Power-over-Ethernet, and options up to five fully configurable I/O channels
- Wi-Fi and Bluetooth® display options for wireless configuration
- Integral field mount, remote field mount, and DIN rail control room mounting options

Diagnostic data

- Smart Meter Verification — checks the health and integrity of the meter's tubes, electronics, and calibration without interrupting the process
- Zero verification — quickly diagnoses the meter to determine if re-zeroing is recommended, and if process conditions are stable and optimal for zeroing
- Multiphase detection — proactively identifies multiphase process conditions and severity
- Time-stamped digital audit trails and reports for optimized agency compliance

SMART METER VERIFICATION

Communication protocols

Typical I/O connectivity options include:

- 4-20 mA
- HART®
- 10k Hz pulse
- *Wireless*HART® with THUM adapter
- Wi-Fi and Bluetooth® display options
- EtherNet/IP™
- Modbus® TCP
- FOUNDATION™ Fieldbus
- PROFINET
- PROFIBUS-PA
- PROFIBUS-DP
- Discrete I/O

Transmitter compatibility and primary attributes

For a complete list of all transmitter configurations and options, see the transmitter product data sheets and other resources available at www.emerson.com.

Model	Transmitter					
	1500/2500	1600	1700/2700	4200	4700	5700
						
Power						
AC			•		•	•
DC	•	•	•		•	•
Loop powered (2-wire)				•		
Diagnostics						
SMV basic (included)	•	•	•	•	•	•
SMV Pro	•	•	•	•	•	•
Real time clock		•		•	•	•
Onboard data historian		•		•	•	•
Local operator interface						
2-line display			•			
Graphical display		•		•	•	•
Certifications and approvals						
SIS certified			•	•	•	•
Custody transfer			•		•	•
Installation options						
Integral mount		•		•	•	
Remote mount	•	•	•	•	•	•

Physical specifications

Materials of construction

General corrosion guidelines do not account for cyclical stress, and therefore should not be relied upon when choosing a wetted material for your Micro Motion meter.

For material compatibility information, see the Micro Motion Corrosion Guide.

Wetted path materials

Model	Material options	Sensor weight[1]
	316/316L	
G025	•	8 lb (3.6 kg)
G050	•	10 lb (4.5 kg)
G100	•	12 lb (5.4 kg)
G200	•	40 lb (18.1 kg)
G300	•	77 lb (35 kg)

(1) *Weight specifications are based upon ASME B16.5 CL150 flange and do not include electronics.*

Non-wetted part materials

Component	Enclosure rating	300 series stainless steel	Polyurethane-painted aluminum
Sensor housing	Type 4X (IP66/IP67)	•	
Core processor housing	Type 4X (IP66/67)	•	•
Junction box	Type 4X (IP66/IP67)	•	•
Transmitter housing[1]	Type 4X (IP66/IP67)	•	•

(1) *Material of construction and surface finish options vary by model. For available options, see the transmitter Product Data Sheet.*

Flow tube information

Model	Number of tubes	Tube inside diameter		Tube length	
		Inches	mm	Inches	mm
G025	2	0.21	5.3	8.81	216
G050	2	0.33	8.5	10.9	276
G100	2	0.51	13	11.7	296
G200	2	1.1	27	21.4	545
G300	2	1.6	40	23.5	597

Process connections

Sensor type	Flange type
Stainless steel 316L	■ ASME B16.5 compatible raised face flange (up to CL600) ■ EN 1092-1 compatible weld neck flange Type B1 (up to PN100) ■ Jis B2220 compatible weld neck raised face (up to 10K) ■ Hygienic Tri-Clamp® compatible ■ VCO, VCR Swagelok-compatible fitting VCO fittings include the Viton o-ring as a wetted part)

Note
For flange compatibility, refer to Flow Measurement Sizing and Selection Tool tool.

Dimensions

These dimensions are intended to provide a basic guideline for sizing and planning. For complete and detailed dimensional drawings, access the Micro Motion Dimensional Drawings tool at MyEmerson.

Note
- Accuracy = ±0.12 in (±3.0 mm)
- These drawings are representative of a 316 stainless steel model fitted with an ASME B16.5 CL150 flange, and 800 enhanced core electronics.

Example dimensions for G-Series models

Figure 4: G-Series Models Dimensions

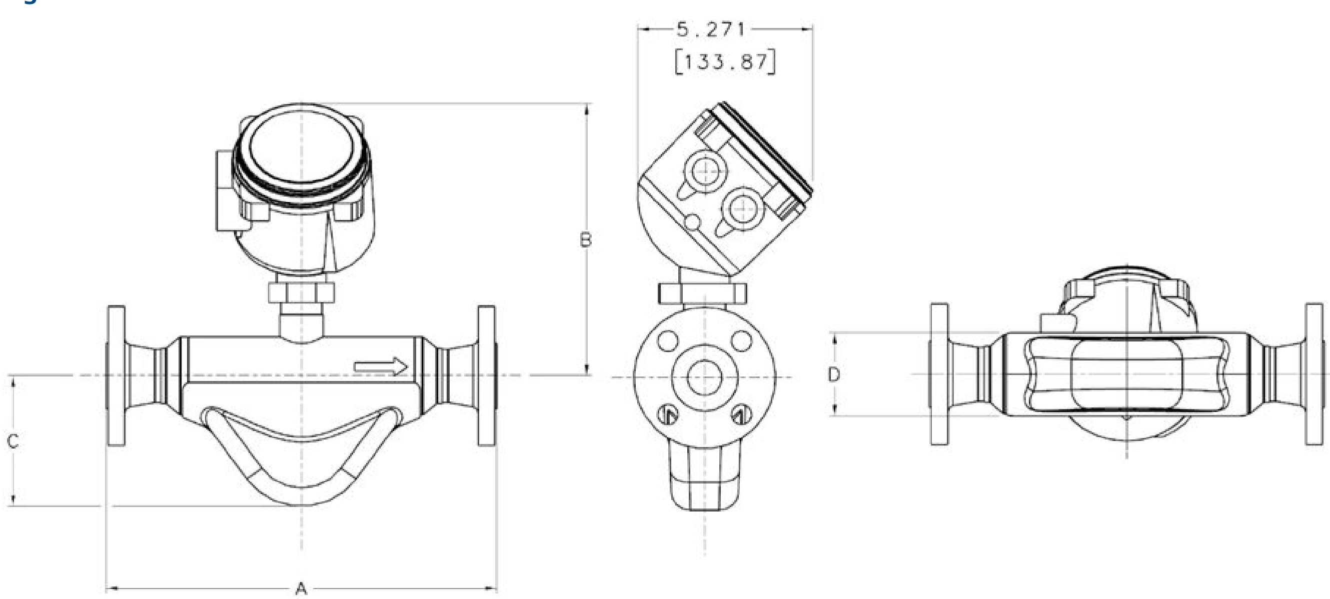


Table 1: Sample Dimensions in inches

	Dim A					
Model	**ASME B16.5 CL150**	**EN1092 PN40**	**NAMUR NE132 flange to flange length**	**Dim. B w/Integral 800 Core**	**Dim. C**	**Dim. D**
G025	8.11	8.33	20.14	8.03	3.18	2.00
G050	9.88	10.00	20.13	8.30	3.86	2.50
G100	11.89	11.59	23.62	8.30	3.98	2.50
G200	20.79	20.91	28.15	9.11	7.40	4.26
G300	23.0	23.07	36.02	9.89	7.45	5.77

Table 2: Sample Dimensions in mm

	Dim A					
Model	**ASME B16.5 CL150**	**EN1092 PN40**	**NAMUR NE132 flange to flange length**	**Dim. B w/Integral 800 Core**	**Dim. C**	**Dim. D**
G025	206	211	510	204	81	51
G050	251	254	510	211	98	63
G100	302	294	600	211	101	63
G200	528	531	715	231	188	108
G300	584	586	915	251	189	147

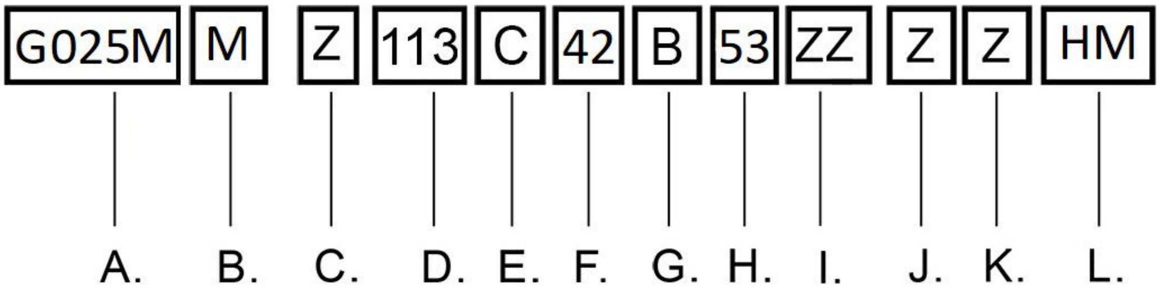
Ordering information

To select and build your meter, please refer to the Flow Measurement Sizing and Selection Tool.

To jump directly to configuration options, go to www.emerson.com to access the G-Series family page in order to view options and build your meter.

Example model code – standard

Please visit MyEmerson for complete model code information.



A. *Sensor base model*
B. *Wetted surface finish*
C. *Pre-selected option*
D. *Process connection*
E. *Case option*
F. *Electronics interface*
G. *Conduit connection*
H. *Approval*
I. *Future option*
J. *Calibration option*
K. *Factory option*
L. *Certificates, tests, calibrations, and services (not required)*

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For more information: **Emerson.com**

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