

Micro Motion™ CNG050 Compressed Natural Gas Flow Meters



Global industry standard for compressed natural gas metering

- A single-meter solution specifically designed for use in both light and heavy duty vehicle dispensers
- AGA 11-approved for the fiscal transfer of CNG
- Micro Motion MVD™ Direct Connect™ technology for transmitter-less integration into dispenser head electronics
- Variety of transmitter options provide multivariable outputs to accommodate any dispenser design requirements
- Compact design with no moving parts, no special mounting or flow conditioning required

Micro Motion Compressed Natural Gas (CNG) flowmeters

Micro Motion CNG050 meters are specifically designed for the CNG industry to meet the challenges of measuring compressed natural gas. The meter's increased rangeability allows customers the flexibility to use the sensor for automobile or light- or heavy-duty vehicle dispenser designs.

Coriolis meters

Coriolis meters offer dramatic benefits over traditional volumetric measurement technologies. Coriolis meters:

- Deliver accurate and repeatable process data over a wide range of flow rates and process conditions.
- Provide direct inline measurement of mass flow and density, and also measure volume flow and temperature—all from a single device.
- Have no moving parts, so maintenance costs are minimal.
- Have no requirements for flow conditioning or straight pipe runs, so installation is simplified and less expensive.
- Provide advanced diagnostic tools for both the meter and the process

CNG050 meters

The CNG050 meter was specifically designed for the CNG industry to meet the challenges of measuring compressed natural gas. The meter's increased rangeability allows customers the flexibility to use the sensor for automobile or light- or heavy-duty vehicle dispenser designs.

Micro Motion CNG050 meters feature integral transmitters, making them easy to install. Offered with Series 1000 and 2000 transmitters with MVD technology, customers can choose either single or multivariable output configurations with milliamp, pulse, dual pulse, digital outputs, and an integral display.

Micro Motion MVD Direct Connect technology is making Coriolis flowmeters from Micro Motion even more suitable for CNG applications. OEMs can benefit from MVD Direct Connect technology, which allows smart sensors to communicate directly with dispenser head electronics via Modbus—no transmitter is required.

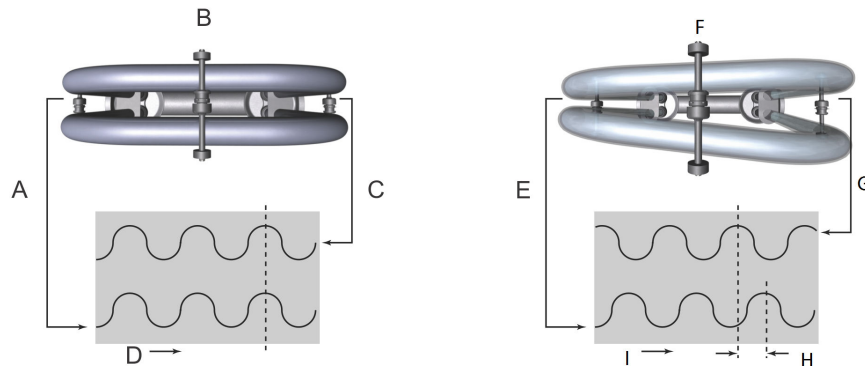
Measurement principles

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.

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>.



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

Vehicle filling

Because of its clean combustion, CNG is increasingly used as a vehicle fuel in many parts of the world. Micro Motion CNG050 meters used in dispenser stations are routinely verified (proved) against a gravimetric standard, the highest performance rating possible. In addition, the CNG050 meter can be used as a Master Meter standard, thus providing increased safety and eliminating cumbersome scale setup and venting of gas.

Weights & Measures configuration lockout

For applications that require Weights & Measures approval for legal trade (i.e., public CNG stations), order the Weights & Measures configuration lockout software option for 2500 and 2700 transmitters with the CNG050 sensor. The configuration lockout software option allows the transmitter to be changed from operating (secure) mode to configuration mode (and back again) using ProLink™ software. The transmitter will register flow only when in the operating (secure) mode. The transmitter will allow configuration changes and zeroing of the meter only when in configuration mode.

When the configuration lockout option is ordered, a means is provided for physically sealing the transmitter housing.

The configuration lockout software option may not be required by certain world area Weights & Measures authorities. The performance of the CNG050 sensor is not affected by configuration lockout, and the sensor meets batch and accuracy specifications with standard features.

Performance specifications

Typical CNG batch/dispensing conditions

For determining the performance capabilities of our meters, the typical batch/dispensing conditions are defined as those where the flow rate is greater than 4 lbs/min (109 kg/hr).

Accuracy and repeatability

Performance specifications	Value
Batch accuracy ⁽¹⁾	±0.50% of batch
Repeatability	±0.25% of rate

(1) In terms of percent of total batch delivered on CNG.

Flow range

Performance specification	All models		Standard volume ⁽¹⁾	
	lb/min	kg/min	SCFM	Nm ³ /hr
Flow range	2 to 220	1 to 100	40 to 4444	68 to 7550

(1) CNG with SG= 0.66 at 60 °F (16 °C) and 14.73 psia (1 bara).

Zero stability

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 rating, as depicted in the turndown section. When operating at flow rates where meter accuracy begins to deviate from the stated accuracy rating, accuracy is governed by the formula: accuracy = (zero stability/flow rate) x 100%. Repeatability is similarly affected by low flow conditions.

Performance specification	All models		Standard volume ⁽¹⁾	
	lb/min	kg/min	SCFM	Nm ³ /hr
Zero stability	0.02	0.009	18	8

(1) In terms of percent of total batch delivered on CNG.

Process pressure ratings

Sensor maximum working pressure reflects the highest possible pressure rating for a given sensor with the process fitting as indicated. Fittings are rated to 5,800 psi (400 bar) – the Union SWG type fitting according to ASME B31.3, and the SAE fitting according to SAE J1453.

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

The case was designed to protect the sensor components, but it is not rated for pressure containment. For added safety, the sensor has a pressure relief feature to evacuate the case in the unlikely event of a loss of primary containment.

Table 1: Sensor maximum working pressure for all models

Component	Rating
Flow tube	5,800 psi (400 bar)
Combined sensor and process fitting	5,800 psi (400 bar)
Union to NPT adapter piece ⁽¹⁾	4,600 psi (317 bar)

(1) Pressure rating of the additional adapter piece (#12 O-ring face seal to female NPT) that is provided with process connection option 239.

Operating conditions: Environmental

Vibration limits

Meets IEC 60068-2-6, endurance sweep, 5 to 2000 Hz, 50 sweep cycles at 1.0 g.

Temperature limits

Component	Limit
Process fluid temperature	-40 °F (-40 °C) to 257 °F (125 °C)
Ambient temperature	-40 °F (-40 °C) to 140 °F (60 °C)

Note

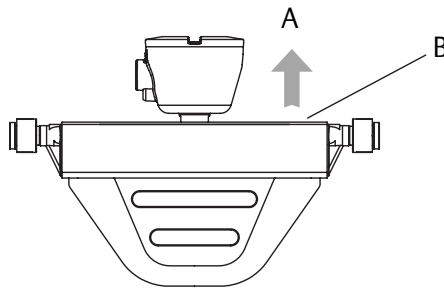
- In all cases, the electronics cannot be operated where the ambient temperature is below -40 °F (-40 °C) or above 140 °F (60 °C). If a sensor is used where the ambient temperature is outside of the range permissible for the electronics, the electronics must be remotely located where the ambient temperature is within the permissible range.
- Temperature limits may be further restricted by hazardous area approvals. Refer to the hazardous area approvals documentation shipped with the sensor or available at www.emerson.com/flowmeasurement.

Operating conditions: Process

Pressure relief

The sensor has a pressure relief feature to evacuate the case in the unlikely event of a loss of primary containment.

- The pressure relief feature is located underneath the calibration tag.




- A. Pressure relief path
- B. Calibration tag

- The sensor must be oriented so that personnel and equipment will not be exposed to escaping pressurized discharge along the pressure relief path.
- If the pressure relief feature is activated by a loss of primary containment, the calibration tag will release from the case.

Hazardous area classifications

Approvals and certifications

Type	Approval or certification (typical)
CSA and CSA C-US	Class I, Div. 1, Groups C and D
CSA (Canada only)	Class I, Div. 2, Groups A, B, C, and D Class II, Div. 1, Groups E, F, and G
ATEX	 II 2 G Ex ib IIB/IIC T1-T5 II 2 D Ex ib IIIC T*°C Db IP65 NOTE: the H300 is Ex ib IIB; only with approval option code 6 it is Ex ib IIC.
IECEX	Ex ib IIC T1–T5
NEPSI	Ex ib IIC T1–T5
Ingress Protection Rating	IP 66/67 for sensors and transmitters
EMC effects	Complies with EMC directive 2004/108/EC per EN 61326 Industrial
Complies with NAMUR NE-21 (09.05.2012)	

Note

- Approvals shown are for the CNG050 meter configured with a 1000 or 2000 transmitter. Meters with integral electronics may have more restrictive approvals. For details, refer to the transmitter Product Data Sheet.
- When a meter is ordered with hazardous area approvals, detailed information is shipped along with the product.
- More information about hazardous approvals, including detailed specifications and temperature graphs for all meter configurations is available on the CNG050 product page at www.emerson.com/flowmeasurement.

Industry standards

Type	Standard
Weights & Measures for custody transfer applications:	<ul style="list-style-type: none"> National Type Evaluation Program (NTEP) PTB NMI Pattern approval SIRIM Ministry of Consumer Affairs Ufficio Metrico Italiano INMETRO
Industry standards and commercial approvals	<ul style="list-style-type: none"> Pressure Equipment Directive (PED) Canadian Registration Number (CRN) Dual Seal SIL2 and SIL3 safety certifications

Transmitter interface

CNG050 sensors are highly customizable to provide a configuration that is tailor-fit to specific applications.

Robust transmitter offerings allow a multitude of mounting options:

- Compact mounting integral to the sensor
- Field mount variants for harsh conditions
- Compact control room DIN rail packages for optimal locating in a control cabinet
- Specific fit-for-purpose solutions for two-wire connectivity or filling and dosing machinery integration

CNG050 sensors are available with an expansive selection of input and output connectivity options including the following:

- 4-20 mA
- HART™
- WirelessHART™
- DeviceNet
- EtherNet/IP
- Profinet
- FOUNDATION™ fieldbus
- PROFIBUS
- Modbus®
- Other protocols may be available on request

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, refer to the *Micro Motion Corrosion Guide*.

Wetted part materials

Model	All models 316L stainless steel	Sensor weight
CNG050	•	13 lb (6 kg)

Note

- Weight specifications are based upon Swagelok® compatible #12 VCO fitting flange and do not include electronics.
- Heat jackets and steam kits are also available.

Non-wetted part materials

Component	Enclosure rating	316L/CF-3M stainless steel	Polyurethane-painted aluminum
Sensor housing	—		
Core processor housing	NEMA 4X (IP66/67)	•	•

Component	Enclosure rating	316L/CF-3M stainless steel	Polyurethane-painted aluminum
Junction box housing	NEMA 4X (IP66)	•	•
1700/2700 transmitter housing	NEMA 4X (IP66)	•	•
3700 transmitter housing	NEMA 4X (IP66/67)		•

Flanges

Sensor type	Flange types
CNG050	<ul style="list-style-type: none"> ■ 3/4-inch NPT female Swagelok compatible size 12 VCO fitting ■ Swagelok compatible size 12 VCO union fitting ■ Union size 12 SAE fitting (universal thread)

Note

For flange compatibility, please refer to the Online Store Sizing and Selection Tool at www.emerson.com/flowmeasurement.

Dimensions

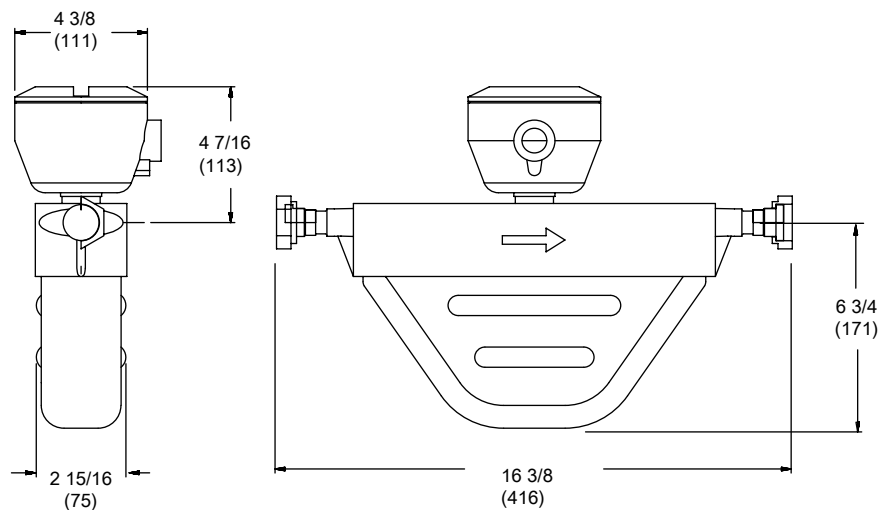
These dimensional drawings are intended to provide a basic guideline for sizing and planning. They are representative of a sensor fitted with a Swagelok compatible size 12 VCO fitting and integral core processor.

Complete and detailed dimensional drawings can be found through the product link in our online store at www.emerson.com/flowmeasurement.

Note

- All dimensions ± 0.118 in (± 3.0 mm)
- Representative of a sensor fitted with a Swagelok compatible size 12 VCO fitting and integral core processor.

Example dimensions for all models



Note

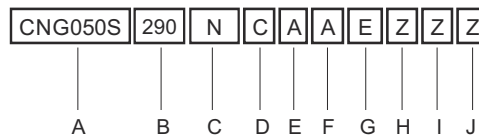
All dimensions are in inches (mm).

Ordering information

Use this section to select the correct ordering codes for your configuration.

Example model code

The sensor is shipped with a model code stamp so that after purchase, you can verify the ordering codes described in this section.



- A. Sensor and model
- B. Process connection
- C. Case option
- D. Electronics interface
- E. Conduit connection
- F. Approval
- G. Language
- H. Future option 1
- I. Calibration option
- J. Factory option

Sensor base model

Code	Case option
CNG050S	Micro Motion Coriolis CNG-Series sensor; 0.5 in (13 mm); 316L stainless steel

Process connections

Code ⁽¹⁾	Description
239	3/4-inch NPT female Swagelok compatible size 12 VCO fitting; 3/4-inch NPT female adapter O-ring face seal adapter rated to 4,600 psi (317 bar)
290	Swagelok compatible size 12 VCO union fitting; ready for face seal O-ring (not included)
291	Union size 12 SAE fitting (universal thread); ready for face seal O-ring (not included)

⁽¹⁾ Fittings listed here are standard options. Other types of fittings are available. Contact your local Micro Motion representative.

Case options

Code	Case option
N	Standard case

Electronics interface

Code	Electronics interface
Q	4-wire polyurethane-painted aluminum integral core processor for remote mount transmitters
A	4-wire stainless steel integral core processor for remote mount transmitters
C	For integrally mounted 1700/2700 transmitter
W ⁽¹⁾	Polyurethane-painted aluminum integral core processor for MVD Direct Connect installation
D ⁽¹⁾	Stainless steel integral core processor for MVD Direct Connect installation

(1) When electronics interface W or D is ordered with approval codes C, A, Z, I, or P, an MVD Direct Connect I.S. barrier is supplied. No barrier is supplied when ordered with approval codes M or N.

Conduit connections

Code	Conduit connection
	Electronics interface codes Q, A, W and D
B	1/2-inch NPT – no gland
E	M20 – no gland
F	Brass/nickel cable gland (cable diameter 0.335 in (8.5 mm) to 0.394 in (10.0 mm))
G	Stainless steel cable gland (cable diameter 0.335 in (8.5 mm) to 0.394 in (10.0 mm))
	Electronics interface code C (integrally mounted 1700/2700)
B	No gland

Approvals

Code	Approval
M	Micro Motion Standard (no approval)
N	Micro Motion Standard / PED compliant
C	CSA (Canada only)
A	CSA C-US (U.S.A. and Canada)
Z	ATEX – Equipment Category 2 (Zone 1) / PED compliant
I	IECEX – Zone 1
P	NEPSI; Available only with language code M (Chinese).
G	Country Specific Approval – Requires a selection from the Approvals section of the “Certificate, Tests, Calibrations and Services” model code option

Languages

Code	Language option
A	Danish CE requirements document and English installation manual
D	Dutch CE requirements document and English installation manual
E	English installation manual
F	French installation manual
G	German installation manual
H	Finnish CE requirements document and English installation manual
I	Italian installation manual
J	Japanese installation manual
M	Chinese installation manual
N	Norwegian CE requirements document and English installation manual
P	Portuguese installation manual
S	Spanish installation manual
W	Swedish CE requirements document and English installation manual
B	Hungarian CE requirements document and English installation manual
K	Slovak CE requirements document and English installation manual
T	Estonian CE requirements document and English installation manual
U	Greek CE requirements document and English installation manual
L	Latvian CE requirements document and English installation manual
V	Lithuanian CE requirements document and English installation manual
Y	Slovenian CE requirements document and English installation manual

Future option 1

Code	Future option 1
Z	Reserved for future use

Future option 2

Code	Calibration option
Z	Reserved for future use

Measurement application software

Code	Measurement application software option
Z	No measurement application software
A	Petroleum measurement; available with electronics interface codes W, D, Y and E; for electronic interface codes Q, A, V, B, C, select Petroleum

Factory options

Code	Factory option
Z	Standard product
X	ETO product
R	Restocked product (if available)

Certificates, tests, calibrations, and services

These option codes can be added to the end of the model code if needed, but no code is required when none of these options is selected.

Note

There may be additional options or limitations depending on total meter configuration. Contact a sales representative before making your final selections.

Material quality examination tests and certificates

Select any from this group.

Code	Factory option
MC	Material inspection certificate 3.1 (supplier lot traceability per EN 10204)
NC	NACE certificate 2.1 (MR0175 and MR0103)

Radiographic testing

Select only one from this group.

Code	Factory option
RE	X-ray package 3.1 (radiographic examination certificate; weld map; radiographic inspection NDE qualification)
RT	X-ray package 3.1 (radiographic examination certificate with digital image; weld map; radiographic inspection NDE qualification)

Pressure testing

Code	Factory option
HT	Hydrostatic test certificate 3.1

Weld examination

Code	Factory option
WP	Weld procedure package (weld map, weld procedure specification, weld procedure qualification record, welder performance qualification)

Special cleaning

Code	Factory option
O2	Declaration of compliance oxygen service 2.1

Metrology compliance

Code	Factory option
GR	Russian GOST calibration verification certificate

Accredited calibration

Code	Factory option
IC	ISO17025 accredited calibration and certificates (9 points total)

Special calibration options

Select either none, CV, or CV with one of the additional verification point options.

Note

For all special calibration options, the minimum flow rate for any verification point is 5% of sensor nominal flow rate.

Code	Factory option
CV	Custom verification (alter original verification points)
01	Add one additional verification point
02	Add two additional verification point
03	Add three additional verification point
06	Add up to six additional verification points
08	Add up to eight additional verification points
16	Add up to 16 additional verification points

Sensor completion options

Select any from this group.

Code	Factory option
WG	Witness general
SP	Special packaging

Country specific approvals

Select one from the following if approval code G is selected.

Code	Factory option
R1	EAC Zone 1 – Hazardous Approval ⁽¹⁾⁽²⁾
B1	INMETRO Zone 1 – Hazardous Approval ⁽¹⁾⁽²⁾

(1) *Only available with approval code G.*

(2) *Not available with electronics code 0, 1, K, or L.*

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