

Applications

The DigitalFlow GC868 clamp-on gas flowmeter is a complete ultrasonic flow metering system for measurement of most gases, including:

- Natural gas
- Compressed air
- Fuel gases
- Erosive gases
- Corrosive gases
- Toxic gases
- High-purity gases
- Air separation gases
- Steam

Features

- Clamp-on unobstructed installation
- No wetted parts
- Two-channel/two-path version available
- No moving parts
- No pressure drop
- Sound speed output
- Simple installation
- Standard volumetric flow calculation
- Steam mass flow
- Supercompressibility compensation
- Suitable for a wide range of temperatures and pressures

DigitalFlow™ GC868

Panametrics Clamp-On Gas Ultrasonic Flowmeter

DigitalFlow GC868 is a Panametrics product. Panametrics has joined other GE high-technology sensing businesses under a new name—GE Industrial, Sensing.



The Second Generation in Clamp-On Gas Ultrasonic Flow Measurement

Historically, clamp-on flow metering was limited to liquids because existing methods could not work on metal pipes containing gases. Several years ago GE developed a new technology that extends all the benefits of clamp-on flow metering to gas measurement.

This breakthrough clamp-on gas flowmeter technology has continued to improve, resulting in the second generation of the DigitalFlow GC868 flowmeter. This remarkable ultrasonic flowmeter works with gases at high or low pressure in pipes made of metal and most other materials.

The DigitalFlow GC868 flowmeter can be used to measure the flow of any gas. It is especially useful for metering erosive, corrosive, toxic, high-purity or sterile gases, or in any application where penetrating the pipe wall is undesirable. Since no tapping or cutting of the pipe is required, permanent installation costs are significantly reduced. The meter has no wetted or moving parts, rarely requires maintenance, causes no pressure drop and has very wide rangeability.

The new meter was tested extensively on metal tubes with diameters as small as 0.75 in (20 mm) and pipes as large as 24 in (600 mm). Suitable applications for this meter include flow measurements of air, hydrogen, natural gas, steam and many other gases. Using patented Correlation Transit-Time™ detection techniques, demonstrated accuracy is superb at better than ± 2 percent of reading with ± 0.5 percent repeatability.

A DigitalFlow GC868 system comprises the DigitalFlow GC868 electronics, a pair of advanced clamp-on gas ultrasonic transducers, a preamplifier, and a clamping fixture for mounting the transducers on the pipe.

Advanced Clamp-On Ultrasonic Transducers

One of the biggest challenges in developing clamp-on ultrasonic transducers for gas applications is the difficulty in transmitting a coded ultrasonic signal through a metal pipe wall, through the gas, and then back through the pipe wall to the second transducer that

is waiting to receive the signal. In gas systems, only 4.9×10^{-7} percent of the transmitted sound energy is actually received by traditional ultrasonic transducers. This simply isn't enough to produce reliable measurements.

The new line of clamp-on gas transducers produces signals that are five to ten times more powerful than those of traditional ultrasonic transducers. The new transducers produce clean, coded signals with very minimal background noise. The result is that the DigitalFlow GC868 flowmeter system performs well even with low-density gas applications.



GE technologically advanced clamp-on gas ultrasonic transducers

No Pressure Drop, Low Maintenance

Because the transducers clamp onto the outside of the pipe, they do not obstruct the flow inside the pipe. This prevents the pressure drops typically caused by other types of flowmeters. The DigitalFlow GC868 has no components that will foul or collect debris, and there are no moving parts to wear out. As a result, it requires no lubrication and little or no routine maintenance.

Wide Range of Clamping Fixtures Available

Transducer alignment is crucial in obtaining accurate measurements in clamp-on gas installations. GE offers a wide range of clamping fixtures to help ensure proper alignment of transducers with minimal effort.

Convenient Installation

Straightforward installation is another advantage of the DigitalFlow GC868 flowmeter. The system consists of one pair of transducers per channel, a clamping fixture, a preamplifier, and an electronics console. The transducers

GE Sensing

are clamped onto the outside of the existing pipe. The electronics console can be located up to 500 ft (150 m) from the transducers. Set-up and output options allow the DigitalFlow GC868 flowmeter to be customized for any process.

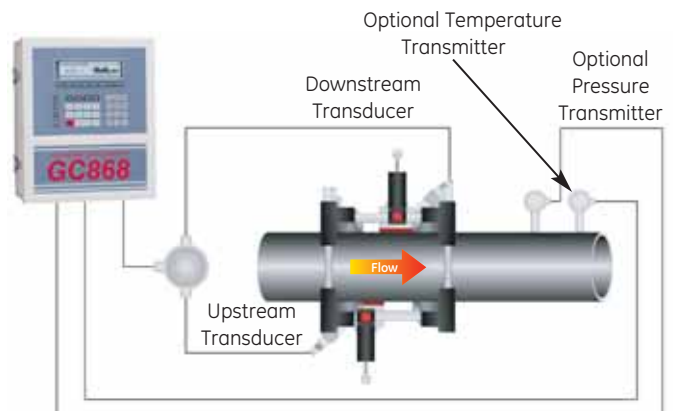
For maximum accuracy, use a two-channel meter to average flow measurement along two different paths at the same location or to measure at two different places in the same pipe. A two-channel meter can also measure the flow in two separate pipes.

Steam Flow

New technology also allows clamp-on measurement of steam mass flow. Conventional steam flowmeters, such as vortex shedding meters, orifice plates or turbines, cause permanent pressure drop. This robs steam of its energy and slows down the process until more steam can be generated. Often, more than one meter may be needed to handle low and high loads separately due to the limited turndown capability of these kinds of meters.

The DigitalFlow GC868 flowmeter eliminates both of these problems. The process does not need to be shut down to install the meter and there's no pressure drop, saving time and money. The DigitalFlow GC868's high turndown capability allows measurement of both low- and high-flow conditions with a single meter.

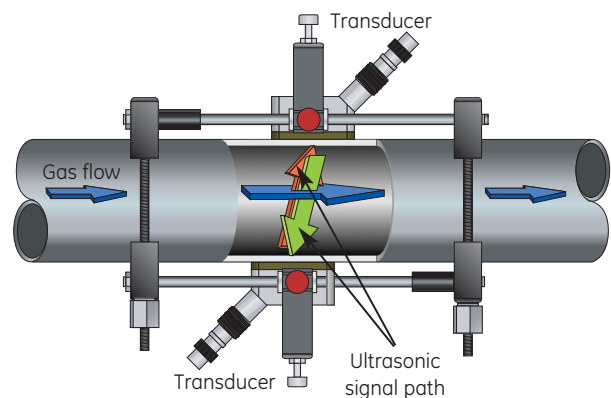
The new transducers are available for process temperature as high as 230°C (446°F), covering a wide range of steam applications. The DigitalFlow GC868 is equipped with steam flow tables for calculating steam mass flow when the meter is configured with appropriate (process dependent) auxiliary inputs for temperature and pressure.



Typical meter set-up for standard volumetric or steam mass flow

The DigitalFlow GC868 Flowmeter Uses the Transit-Time Flow Measurement Technique

The transit-time technique uses a pair of transducers, with each transducer sending and receiving coded ultrasonic signals through the fluid. When the fluid is flowing, signal transit time in the downstream direction is shorter than in the upstream direction; the difference between these transit times is proportional to the flow velocity. The DigitalFlow GC868 measures this time difference and uses programmed pipe parameters to determine flow rate and direction.



Transit-time flow measurement technique

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GC868 Installation Requirements for Air, Nitrogen, Oxygen or Argon

Pipe Size ANSI (DIN)	Pipe Wall in (mm)	Transducer MHz	Minimum Pressure		Maximum Velocity, ft/s (m/s)—Traverse			
			psig (bar)	Single	Dual	Triple	Four	Five
3/4 (20)	≤0.07 (1.8)	1	60 (5.1)	—	—	90 (27.4)	—	90 (27.4)
1 (25)	≤0.14 (3.6)	1	60 (5.1)	—	—	90 (27.4)	—	90 (27.4)
1 1/2 (40)	≤0.15 (3.8)	1	60 (5.1)	—	—	90 (27.4)	—	57 (17.4)
2 (50)	≤0.16 (4.1)	1	60 (5.1)	90 (27.4)	—	75 (22.9)	—	45 (13.7)
3 (75)	≤0.2	1	60 (5.1)	120 (36.6)	—	69 (21.0)	46 (14.0)	—
3 (75)	≤0.22 (5.6)	0.5	60 (5.1)	120 (36.6)	—	69 (21.0)	46 (14.0)	—
4 (100)	≤0.2	1	60 (5.1)	120 (36.6)	—	53 (16.2)	35 (10.7)	—
4 (100)	≤0.24 (6.1)	0.5	60 (5.1)	120 (36.6)	—	53 (16.2)	35 (10.7)	—
4 (100)	≤0.34 (8.6)	0.5	180 (13.4)	120 (36.6)	—	53 (16.2)	35 (10.7)	—
4 (100)	≤0.68 (17.3)	0.5	300 (21.7)	120 (36.6)	—	53 (16.2)	35 (10.7)	—
6 (150)	≤0.2	1	60 (5.1)	90 (27.4)	72 (22.0)	54 (16.5)	—	—
6 (150)	≤0.28 (7.2)	0.5	60 (5.1)	90 (27.4)	72 (22.0)	54 (16.5)	—	—
6 (150)	≤0.28 (7.2)	0.2	60 (5.1)	90 (27.4)	72 (22.0)	54 (16.5)	—	—
6 (150)	≤0.44 (11.2)	0.5	180 (13.4)	90 (27.4)	72 (22.0)	54 (16.5)	—	—
6 (150)	≤0.44 (11.2)	0.2	180 (13.4)	90 (27.4)	72 (22.0)	54 (16.5)	—	—
6 (150)	≤0.87 (22.1)	0.5	300 (21.7)	90 (27.4)	72 (22.0)	54 (16.5)	—	—
6 (150)	≤0.87 (22.1)	0.2	300 (21.7)	90 (27.4)	72 (22.0)	54 (16.5)	—	—
8 (200)	≤0.33 (8.4)	0.5	60 (5.1)	80 (24.4)	64 (19.5)	48 (14.6)	—	—
8 (200)	≤0.33 (8.4)	0.2	200 (13.6)	120 (36.6)	96 (29.3)	72 (21.9)	—	—
8 (200)	≤0.50 (12.7)	0.5	180 (13.4)	80 (24.4)	64 (19.5)	48 (14.6)	—	—
8 (200)	≤0.50 (12.7)	0.2	600 (40.8)	120 (36.6)	96 (29.3)	72 (21.9)	—	—
8 (200)	≤0.88 (22.4)	0.5	300 (21.7)	80 (24.4)	64 (19.5)	48 (14.6)	—	—
8 (200)	≤0.88 (22.4)	0.2	1000 (68)	120 (36.6)	96 (29.3)	72 (21.9)	—	—
10 (250)	≤0.37 (9.4)	0.5	60 (5.1)	70 (21.3)	56 (17.1)	42 (12.8)	—	—
10 (250)	≤0.37 (9.4)	0.2	200 (13.6)	105 (32)	84 (25.6)	63 (19.28)	—	—
10 (250)	≤0.50 (12.7)	0.5	180 (13.4)	70 (21.3)	56 (17.1)	42 (12.8)	—	—
10 (250)	≤0.50 (12.7)	0.2	600 (40.8)	105 (32)	84 (25.6)	63 (19.28)	—	—
10 (250)	≤1.00 (25.4)	0.5	300 (21.7)	70 (21.3)	56 (17.1)	42 (12.8)	—	—
10 (250)	≤1.00 (25.4)	0.5	1000 (68)	105 (32)	84 (25.6)	63 (19.28)	—	—
12 (300)	≤0.38 (9.7)	0.5	60 (5.1)	55 (16.8)	44 (13.4)	33 (10.1)	—	—
12 (300)	≤0.38 (9.7)	0.2	200 (13.6)	82 (25)	66 (20.1)	49 (14.9)	—	—
12 (300)	≤1.00 (25.4)	0.2	180 (13.4)	55 (16.8)	44 (13.4)	33 (10.1)	—	—
12 (300)	≤0.38 (9.7)	0.2	600 (40.8)	82 (25)	66 (20.1)	49 (14.9)	—	—
12 (300)	≤0.50 (12.7)	0.2	300 (21.7)	55 (16.8)	44 (13.4)	33 (10.1)	—	—
12 (300)	≤1.00 (25.4)	0.2	1000 (68)	82 (25)	66 (20.1)	49 (14.9)	—	—
14 (350)	≤0.38 (9.7)	0.2	90 (7.2)	87 (26.5)	70 (21.3)	52 (15.9)	—	—
14 (350)	≤0.50 (12.7)	0.2	270 (19.6)	87 (26.5)	70 (21.3)	52 (15.9)	—	—
16 (400)	≤0.38 (9.7)	0.2	90 (7.2)	76 (23.2)	61 (18.9)	45 (13.7)	—	—
16 (400)	≤0.50 (12.7)	0.2	270 (19.6)	76 (23.2)	61 (18.9)	45 (13.7)	—	—
18 (450)	≤0.38 (9.7)	0.2	90 (7.2)	67 (20.4)	54 (16.5)	40 (12.2)	—	—
18 (450)	≤0.50 (12.7)	0.2	270 (19.6)	67 (20.4)	54 (16.5)	40 (12.2)	—	—
20 (500)	≤0.38 (9.7)	0.2	90 (7.2)	60 (18.3)	48 (14.6)	36 (11.0)	—	—
20 (500)	≤0.50 (12.7)	0.2	270 (19.6)	60 (18.3)	48 (14.6)	36 (11.0)	—	—
24 (600)	≤0.38 (9.7)	0.2	90 (7.2)	49 (14.9)	39 (11.9)	29 (8.8)	—	—
24 (600)	≤0.50 (12.7)	0.2	270 (19.6)	49 (14.9)	39 (11.9)	29 (8.8)	—	—

How to use this table.

- 1) Find pipe size of your application.
- 2) Find pipe wall thickness of your application.
- 2A) Determine if your application meets the minimum pressure requirements given pipe size and pipe wall thickness as determined by pipe wall thickness.
- 2B) Determine maximum flow velocity capability.
- 3) Consult factory for natural gas with sulfur or high carbon dioxide content.
- 4) Consult factory for applications that are not listed above.

GC868 Installation Requirements for Natural Gas

Pipe Size ANSI (DIN)	Pipe Wall in (mm)	Transducer MHz	Minimum Pressure psig (bar)	Maximum Velocity, ft/s (m/s)		
				Single Traverse	Dual Traverse	Triple Traverse
2 (50)	≤ 0.16 (4.1)	0.5	200 (14.8)	110 (33.5)	88 (26.8)	66 (20.5)
3 (75)	≤ 0.22 (5.6)	0.5	200 (14.8)	120 (36.6)	96 (29.3)	72 (22.0)
4 (100)	≤ 0.24 (6.1)	0.5	150 (11.4)	120 (36.6)	96 (29.3)	72 (22.0)
4 (100)	≤ 0.34 (8.6)	0.5	400 (28.6)	120 (36.6)	96 (29.3)	72 (22.0)
4 (100)	≤ 0.68 (17.3)	0.5	800 (56.2)	120 (36.6)	96 (29.3)	72 (22.0)
6 (150)	≤ 0.28 (7.2)	0.5	150 (11.4)	120 (36.6)	96 (29.3)	72 (22.0)
6 (150)	≤ 0.28 (7.2)	0.2	250 (17)	180 (54.9)	144 (43.9)	108 (32.9)
6 (150)	≤ 0.44 (11.2)	0.5	400 (28.6)	120 (36.6)	96 (29.3)	72 (22.0)
6 (150)	≤ 0.44 (11.2)	0.2	500 (34)	180 (54.9)	144 (43.9)	108 (32.9)
6 (150)	≤ 0.87 (22.1)	0.5	800 (56.2)	120 (36.6)	96 (29.3)	72 (22.0)
6 (150)	≤ 0.87 (22.1)	0.2	1000 (68)	180 (54.9)	144 (43.9)	108 (32.9)
8 (200)	≤ 0.33 (8.4)	0.5	175 (13.1)	100 (30.5)	80 (24.4)	60 (18.3)
8 (200)	≤ 0.33 (8.4)	0.2	250 (17)	150 (45.7)	120 (36.6)	90 (27.4)
8 (200)	≤ 0.50 (12.7)	0.5	400 (28.6)	100 (30.5)	80 (24.4)	60 (18.3)
8 (200)	≤ 0.50 (12.7)	0.2	500 (34)	150 (45.7)	120 (36.6)	90 (27.4)
8 (200)	≤ 0.88 (22.4)	0.5	800 (56.2)	100 (30.5)	80 (24.4)	60 (18.3)
8 (200)	≤ 0.88 (22.4)	0.2	1000 (68)	150 (45.7)	120 (36.6)	90 (27.4)
10 (250)	≤ 0.37 (9.4)	0.5	200 (14.8)	85 (25.9)	68 (20.7)	51 (15.6)
10 (250)	≤ 0.37 (9.4)	0.2	300 (20.4)	126 (38.4)	102 (31.1)	75 (22.0)
10 (250)	≤ 0.50 (12.7)	0.5	500 (35.5)	85 (25.9)	68 (20.7)	51 (15.6)
10 (250)	≤ 0.50 (12.7)	0.2	600 (40.8)	126 (38.4)	102 (31.1)	75 (22.0)
10 (250)	≤ 1.00 (25.4)	0.5	800 (56.2)	85 (25.9)	68 (20.7)	51 (15.6)
10 (250)	≤ 1.00 (25.4)	0.2	1200 (81.6)	126 (38.4)	102 (31.1)	75 (22.0)
12 (300)	≤ 0.38 (9.7)	0.5	200 (14.8)	70 (21.3)	56 (17.1)	42 (12.8)
12 (300)	≤ 0.38 (9.7)	0.2	300 (20.4)	105 (32)	84 (25.6)	63 (19.28)
12 (300)	≤ 0.50 (12.7)	0.5	500 (35.5)	70 (21.3)	56 (17.1)	42 (12.8)
12 (300)	≤ 0.50 (12.7)	0.2	600 (40.8)	105 (32)	84 (25.6)	63 (19.28)
12 (300)	≤ 1.00 (25.4)	0.5	800 (56.2)	70 (21.3)	56 (17.1)	42 (12.8)
12 (300)	≤ 1.00 (25.4)	0.2	1200 (81.6)	105 (32)	84 (25.6)	63 (19.28)
14 (350)	≤ 0.38 (9.7)	0.2	300 (21.7)	103 (31.4)	77 (23.5)	62 (18.9)
14 (350)	≤ 0.50 (12.7)	0.2	800 (56.2)	103 (31.4)	77 (23.5)	62 (18.9)
16 (400)	≤ 0.38 (9.7)	0.2	300 (21.7)	90 (27.4)	67 (20.4)	54 (16.5)
16 (400)	≤ 0.50 (12.7)	0.2	800 (56.2)	90 (27.4)	67 (20.4)	54 (16.5)
18 (450)	≤ 0.38 (9.7)	0.2	300 (21.7)	78 (23.8)	59 (18.0)	47 (14.3)
18 (450)	≤ 0.50 (12.7)	0.2	800 (56.2)	78 (23.8)	59 (18.0)	47 (14.3)
20 (500)	≤ 0.38 (9.7)	0.2	300 (21.7)	70 (21.3)	52 (15.9)	42 (12.8)
20 (500)	≤ 0.50 (12.7)	0.2	800 (56.2)	70 (21.3)	52 (15.9)	42 (12.8)
24 (600)	≤ 0.38 (9.7)	0.2	300 (21.7)	56 (17.1)	42 (12.8)	34 (10.4)
24 (600)	≤ 0.50 (12.7)	0.2	800 (56.2)	56 (17.1)	42 (12.8)	34 (10.4)

GC868 Installation Requirements for Steam

Pipe Size ANSI (DIN)	Pipe Wall in (mm)	Transducer MHz	Minimum Pressure psig (bar)	Maximum Velocity, ft/s (m/s) Single Traverse
3 (80)	≤ 0.22 (5.6)	0.5	110 (8.6)	120 (36.6)
3 (80)	≤ 0.3 (7.6)	0.5	200 (14.8)	120 (36.6)
4 (100)	≤ 0.24 (6.1)	0.5	110 (8.6)	120 (36.6)
4 (100)	≤ 0.34 (8.6)	0.5	200 (14.8)	120 (36.6)
6 (150)	≤ 0.28 (7.2)	0.5	110 (8.6)	120 (36.6)
6 (150)	≤ 0.44 (11.2)	0.5	200 (14.8)	120 (36.6)
8 (200)	≤ 0.33 (8.4)	0.5	110 (8.6)	120 (36.6)
8 (200)	≤ 0.50 (12.7)	0.5	200 (14.8)	120 (36.6)
10 (250)	≤ 0.37 (9.4)	0.5	130 (10.0)	85 (25.9)
10 (250)	≤ 0.50 (12.7)	0.5	200 (14.8)	85 (25.9)
12 (300)	≤ 0.38 (9.7)	0.5	140 (10.7)	70 (21.3)
12 (300)	≤ 0.50 (12.7)	0.5	200 (14.8)	70 (21.3)

GC868 Specifications

Operation and Performance

Fluid Types

Acoustically conductive gases with minimum density requirements (see Installation Requirements Table)

Pipe Sizes

- Most gases: 0.75 to 24 in NB (20 to 600 mm DN) and larger
- Steam: 4 to 12 in NB (100 to 300 mm DN)

Pipe Wall Thickness

Thicker walled pipes require higher gas density (see Installation Requirements Table)

Pipe Materials

Most metals and plastics. No lined pipes.

Flow Accuracy (Velocity)

- For pipes 6 in (150 mm) and smaller:
±2% to 5% of reading typical
- For pipes larger than 6 in (150 mm):
±1% to 2% of reading typical

Accuracy depends on pipe size and whether measurement is one-path or two-path. Accuracy to ±0.5% of reading may be achievable with process calibration.

Repeatability

±0.2% to 0.5% of reading

Range (Bidirectional)

See Installation Requirements Table

Rangeability (Overall)

See Installation Requirements Table

Specifications assume a fully developed flow profile (typically 20 diameters upstream and 10 diameters downstream of straight pipe run) and flow velocity greater than 5 ft/s (1.5 m/s).

Measurement Parameters

Standard and actual volumetric flow, and flow velocity

Electronics

Flow Measurement

Correlation Transit-Time mode

Enclosures

- Standard: Epoxy-coated aluminum
Type 4X/IP66 Class I, Division 2, Groups A,B,C&D
- Optional: Stainless steel, fiberglass, explosion-proof, flameproof  II 2 G EEx d IIC T6)

Dimensions

Standard: Weight 11 lb (5 kg), size (h x w x d)
14.24 x 11.4 x 5.1 in (362 x 290 x 130 mm)

Channels

- Standard: One channel
- Optional: Two channels (for two pipes or two-path averaging)

Display

Two independent software-configurable 64 x 128 pixel backlit LCD graphic displays

Keypad

39-key, tactile-feedback membrane keypad

Power Supplies

- Standard: 100 to 130 VAC, 50/60 Hz or 200 to 265 VAC, 50/60 Hz
- Optional: 12 to 28 VDC, ±5%

Power Consumption

20 W maximum

Operating Temperature

-10° to 55°C (14° to 130°F)

Storage Temperature

-40° to 70°C (-40° to 158°F)

Standard Inputs/Outputs

Two 0/4 to 20 mA isolated outputs, 550 Ω maximum load

GC868 Specifications

Optional Inputs/Output

There are six additional slots available for any combination of the following I/O boards:

- Analog outputs: Select up to three additional output boards, each with four isolated 0/4 to 20 mA outputs, 1 k Ω maximum load
- Analog inputs: Select up to three boards of one of the following types:
 - Analog input board with two isolated 4 to 20 mA inputs and 24 V loop power
 - RTD input board with two isolated, three-wire, RTD inputs; span -100° to 350°C (-148° to 662°F); 100 Ω Pt
- Totalizer/frequency outputs: Select up to three totalizer/frequency output boards, each with four outputs per board, 10 kHz maximum. All boards allow software-selectable functioning in two modes:
 - Totalizer mode: Pulse per defined unit of parameter (e.g., 1 pulse/ft³)
 - Frequency mode: Pulse frequency proportional to magnitude of parameter (e.g., 10 Hz = 1 ft³/h)
- Alarm relays: Select up to two boards of one of the following types:
 - General purpose: Relay board with three Form C relays; 120 VAC, 28 VDC maximum, 5 A maximum; DC 30 W maximum, AC 60 VA
 - Hermetically sealed: Relay board with three hermetically sealed Form C relays; 120 VAC, 28 VDC maximum, 2 A maximum; DC 56 W maximum, AC 60 VA

Digital Interfaces

- Standard: RS232
- Optional: RS485 (multiuser)
- Optional: Modbus[®] RS458 or TCP protocol
- Optional: Ethernet
- Optional: OPC server
- Optional: Foundation fieldbus

Site Parameter Programming

Menu-driven operator interface using keypad and “soft” function keys

Data Logging

Memory capacity (linear and/or circular type) to log more than 43,000 flow data points

Display Functions

- Graphic display shows flow in numerical or graphic format
- Displays logged data and diagnostics

European Compliance

Complies with EMC Directive 89/336/EEC, 73/23/EEC LVD (Installation Category II, Pollution Degree 2)

Clamp-On Ultrasonic Flow Transducers

Temperature Ranges

- Standard: -40° to 130°C (-40° to 266°F)
- Optional (overall range): -40° to 230°C (-40° to 446°F)

Mountings


Anodized aluminum or stainless steel clamping fixture with rigid rails, chain or strap

- 0.75 to 1.25 in (20 to 30 mm) pipe: CFG-V1
- 1.25 to 4 in (30 to 100 mm) pipe: CFG-V4
- 4 to 8 in (100 to 200 mm) pipe: CFG-V8
- 8 to 12 in (200 to 300 mm) pipe: CFG-V12
- 12 to 24 in (300 to 600 mm) pipe: CFG-PI

Mounting Couplant

CPL-16

Area Classifications

- Standard: General purpose
- Optional: Weatherproof Type 4X/IP65
- Optional: Explosion-proof Class I, Division 1, Groups B,C,&D
- Optional: Flameproof  II 2 G EEx md IIC T6–T3

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