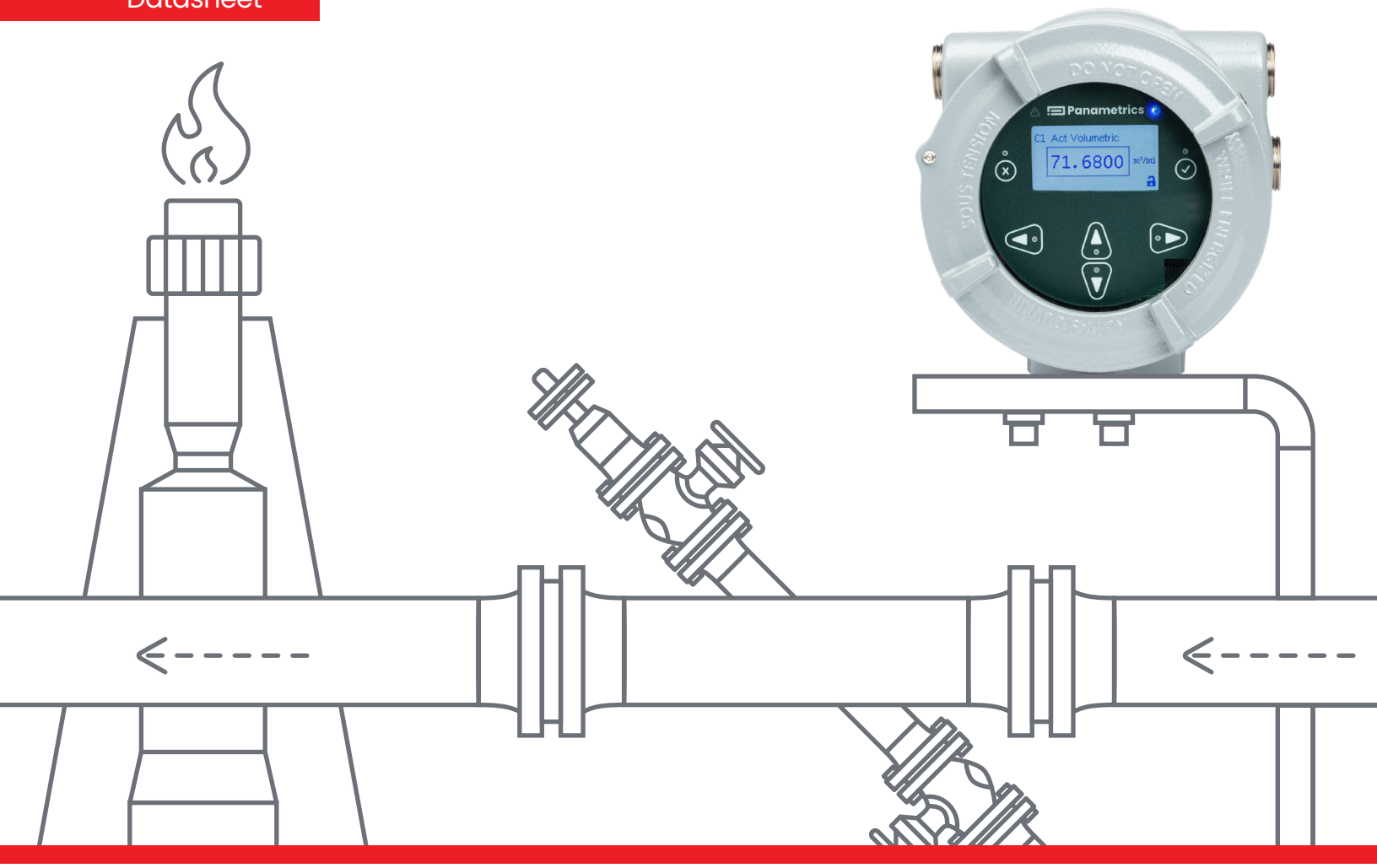
Wir machen's einfach!

THOMSEN Messtechnik
Panametrics

Datasheet



PanaFlare XGF1100

Most advanced next generation flare gas ultrasonic transmitter

Panametrics is the world leader in flare measurement, with a legacy rooted in innovation, precision, and reliability. As the original inventor of the world's first ultrasonic flare flowmeter, Panametrics revolutionized how industries monitor and manage flare systems – setting a new standard for environmental compliance and operational efficiency.

PANA100DS Rev. 2

Flare gas mass flow meter

The XGF1100 ultrasonic flow meter uses the patented Correlation Transit-Time™ technique, digital signal processing, and an accurate method of calculating molecular weight. Adding to these features are the inherent advantages of ultrasonic flow measurement – reliability with no routine maintenance, high accuracy, fast response, and wide rangeability, the XGF1100 flow meter is the clear choice for flare gas applications.

Compact housing

All of the XGF1100's electronic components are housed in a compact, explosion proof/flame proof transmitter package that can be installed close to the flow measurement point. This greatly simplifies wiring of the flowmeter.

Features

- Measures velocity, volumetric flow, mass flow and molecular weight (MW)
- Outputs Net Heating Value (NHV)
- Monitors Combustion Efficiency/Destruction Removal Efficiency (CE/DRE)
- 4000 to 1 turndown ratio
- High velocity range up to 120 m/s (394 ft/s)
- Accurate low flow rate measurement down to 0.03 m/s (0.1 ft/s)
- Flexible up to 4 path configuration (1–4)
- Built-in basic Computational Fluid Dynamics (CFD) correction
- Compensates for compressibility
- Allows cross flow immunity in large pipes
- Field-proven installation techniques with easy serviceability
- Minimal maintenance due to no moving parts, no holes or tubes, and tolerance to dirty or wet conditions, no pressure drop

Applications

XGF1100 is the ideal solution for these applications and purposes:

- Flare gas
- Vent gas
- Hydrocarbon gases
- Biogases
- Digester gases

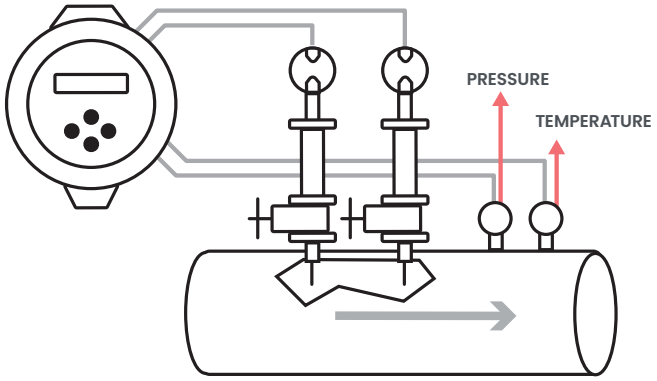
Benefits

- Track down or prevent losses from leakage
- Account for total plant throughput of material
- Reduce cost of steam usage with proportional control
- Conserve energy by eliminating unnecessary flaring
- Comply with government regulations for pollution control

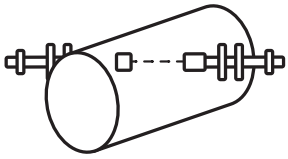
Simple installation

The flow meter system consists of one or more pairs of transducers and insertion mechanism for each channel, and an XGF1100. The transducers can be installed as part of a flowcell, or directly into the pipe with a hot- or cold- tapping procedure. The XGF1100 meter can be located up to 1,000 ft (~300 m) from the transducers.

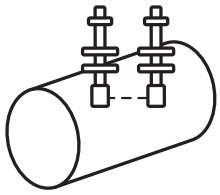
Typical meter set-up for standard volumetric or hydrocarbon mass flow.



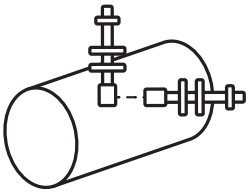
Standard transducer mounting configurations.



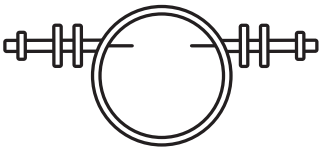
DIAGONAL 45



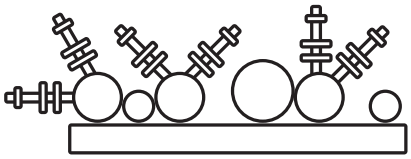
MID-RADIUS 90



90–180 DIAGONAL



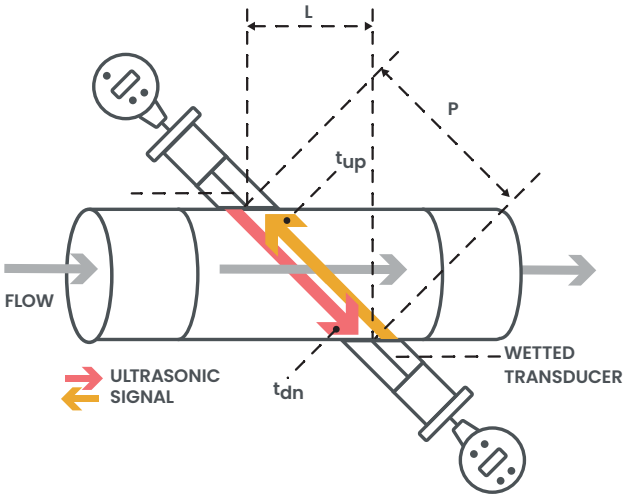
OFF-DIAMETER DIAGONAL 45



PIPE RACK

Best technology for flare gas

Ultrasonic flow measurement, the ideal technology for flare gas applications, is independent of gas properties, and does not generally interfere with the flow. All metal ultrasonic transducers installed in the pipe send sound pulses upstream and downstream through the gas. From the difference in these transit times between the transducers, with and against the flow, the XGF1100's onboard computer uses advanced signal processing and correlation detection to calculate velocity, and volumetric and mass flow rate. Temperature and pressure inputs enable the meter to calculate standard volumetric flow, calculate the molecular weight and the mass flow.



$$V = \frac{P^2}{2L} * \frac{(t_{up} - t_{dn})}{(t_{up} * t_{dn})}$$

$$Q_{STD} = Q_{ACT} * \left(\frac{P_{ACT}}{P_{STD}}\right) * \left(\frac{T_{STD}}{T_{ACT}}\right) * Z$$

V	Actual Velocity
P	Path length
L	Axial length
t_{up}	Upstream transit time
t_{dn}	Downstream transit time
Q_{STD}	Standard volumetric flow rate
Q_{ACT}	Actual volumetric flow rate
P_{STD}	Pressure at standard reference conditions
P_{ACT}	Pressure at actual, flowing conditions
T_{STD}	Temperature at standard reference conditions
T_{ACT}	Temperature at actual, flowing conditions
Z	Compressibility

Ideal for flare gas flow measurement

The Correlation Transit-Time technique has distinct advantages over other methods of flare gas flow measurement, and it is used to solve a variety of difficult problems. Typically, gas in flare stacks, headers or laterals is a mixture of components from different sources. Flow rate in flare systems may be unsteady or even bidirectional. Pulsating pressure, varying composition and temperature, harsh environment, and wide flow range further complicate the measurement. With the zero routing flaring policy gaining ground, a lot of flare systems are running at very low flow conditions under normal operations. The XGF1100 is designed for superior performance under these conditions.

Energy measurement

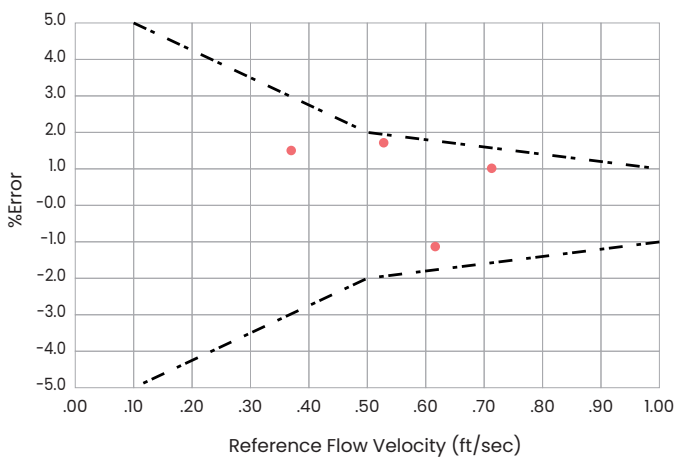
Latency in measuring the energy content of a flare gas can lead to poor combustion efficiency or fuel gas waste at the flare tip. This can lead to excessive emissions, mostly harmful methane, into the atmosphere, risking increased fine associated with non-compliance and greater negative impact on the climate. The model XGF1100 has an option for measuring the net heating value (NHV) of the flare gas to help operators optimize their assisted flares to provide a smokeless flame and maintain a high combustion efficiency without the latency issues or the installation and maintenance costs of a separate analyzer. For increased capabilities unlocking the full potential of reduced emissions and flare control and optimization, use XGF1100 with flare.IQ advanced control solution.

One meter, wide range of flow conditions

Low flow

For base load operation, the volumetric flow in flares is often in the range 0.1 to 1 f/s (0.03 to 0.3 m/s) and the XGF1100 flare gas flowmeter improves the accuracy over that range thanks to its superior timing resolution (consult factory for details).

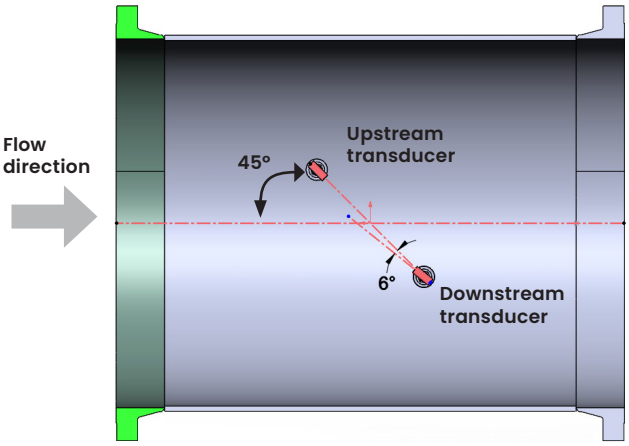
XGF1100 low flow % error



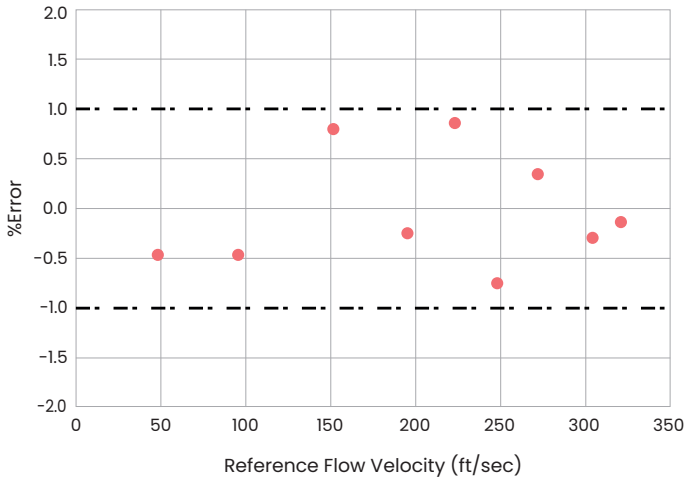
High flow

The XGF1100 meter achieves extended rangeability up to 4000 to 1. In steady or rapidly changing flow, it measures in pipes from 3 in to 130 in (80 mm to 3.25 m) in diameter. With this range of operation, one XGF1100 flowmeter performs measurements under the conditions that occur in a flare line on or offshore. Depending on the application, Panametrics might apply a recovery angle as needed as shown below (consult factory for details).

The 6 degree recovery angle on the downstream transducer provides high flow rate capability.



Calibrated Accuracy for a 6-inch flare meter with XGF1100 for high flow



Multi-path/channel model standard

XGF1100 is the first ultrasonic flare transmitter that can offer up to 4 paths. As global regulation is tightening and flare gas measurement is becoming more of a fiscal metering, multi-path flare configuration is becoming more demanding than ever for reasons including accuracy improvement, tolerance of non-ideal installation conditions and measurement redundancy. Once again, Panametrics is pushing the technology frontier by launching an up to 4 path flare transmitter.

Designed for flare gas environment

The XGF1100 based flowmeter has no moving parts to clog or wear out. Its patented ultrasonic transducers are constructed of titanium or other metals that withstand the corrosive environment usually found in flare gas applications. The transducers are designed for use in hazardous locations. In contrast to other flow meter types, the ultrasonic transit-time technique does not depend on the properties of flare gas and does not require regular maintenance.
The XGF1100 based flowmeter system offers a unique combination of rangeability, ease of installation, low maintenance and accuracy in a cost effective transmitter. The all-digital XGF1100 creates no or minimum pressure drop; has no moving parts or parts that foul or collect debris; seldom requires maintenance; and provides reliable, drift-free operation. The flow rate can be displayed locally or transmitted to a digital control system via an analog or digital communications link.

Patented molecular weight measurement method

The XGF1100 uses a patented method for calculating the average molecular weight of hydrocarbon mixtures. This proprietary algorithm extends the range for measuring average molecular weight, while improving accuracy and compensating for non-hydrocarbon gases better than ever before possible. Normally sound speed in gases depends on gamma.

$$C = \sqrt{\frac{\gamma(R)T_{ACT}}{MW}}$$

The algorithm in the meter relates sound speed of the gases to the average molecular weight of the gases, without a dependency on heat capacity ratio, for hydrocarbon gases. Molecular weight, with temperature and pressure, allows the mass flow to be calculated.

$$\rho = \frac{P_{ACT}(MW)}{R(T_{ACT})}$$

ρ = Density
P = Pressure (absolute)
T = Temperature (absolute)
R = Universal gas constant
MW = Molecular weight
Q = Volumetric flow rate
y = Gamma: adiabatic constant
C = Speed of sound

Identify leaks, reduce steam usage, improve plant balance, and comply with emissions regulation

Higher accuracy mass flow data and more precise knowledge of flare gas composition can improve the efficiency of plant operation.

Leaks/lost product
Detection of even a small increase in flow rate into the flare system may indicate a leak source such as a partially unseated relief valve. An accompanying change in the average molecular weight of the flare gas may be used to help locate the leak source. Quick identification and elimination of leak sources into the flare system saves significant amounts of potentially lost energy and product and aids in early detection of process control problems.

Steam injection/mass balance
Excess steam delivery can be a major cause of loss of product and energy as well as destruction efficiency reduction. Reducing steam injection improves the overall efficiency in refinery and chemical plant operation. The XGF1100 can help save millions of dollars in reduced losses. Using the instantaneous average molecular weight and mass flow rate of the gas, delivery of the correct amount of steam required at the flare tip can be accurately controlled. Steam usage can be reduced. Mass flow rate may be used to perform a mass balance calculation and to control flare tip steam injection.

Emissions compliance
Maintaining compliance with pollution control regulations requires measurement at low flow and at high flow, and verification of meter performance. The sound speed and other diagnostics allow easy meter verification while measuring over this wide flow range.
Ability to remain operational and accurate when using nitrogen purging at very low flow when operating assets adopt the zero routine flaring policy from the World Bank.

Low operational costs

Because the XGF1100 based flowmeter installation produces no or minimum flow obstruction, the energy-robbing pressure drops and high maintenance requirements characteristic of other flow meters are eliminated. The special sealed metal transducers supplied with a XGF1100 system are immune to the erosion and stress caused by thermal expansion cycles, and their high performance made them able to withstand the most demanding process conditions.
Payback for the entire XGF1100 installation usually occurs within a matter of months.

API 22.3

XGF1100 is compliant with API 22.3, fully tested and validated through a third party calibration laboratory (consult factory for details). API 22.3 is a testing protocol written to help end users evaluate the capabilities and performance of given flare gas flowmeters under different installation configurations.

Compressibility correction

Flare gas application is normally under lower pressure. In special cases, flare gas meter can operate under higher pressures, including certain offshore applications. In these cases, compressibility can start to play a more important role in calculating actual flows. XGF1100 adopts an optional feature of compressibility calculation to enhance the accuracy of measurement (consult factory for details).

CE/DRE

Panametrics leads the way in real-time monitoring combustion efficiency (CE) and destruction removal efficiency (DRE) for unassisted flares.
With this live CE/DRE measurement feature, operators gain accurate insights into their emissions, enabling smarter decisions and improved environmental compliance and reporting (consult factory for details).

Built-in basic Computational Fluid Dynamics

Panametrics XGF1100 offers certain built-in CFD capability to compensate for the lack of installation straight runs by applying correction factors to improve measurement accuracy. This capability helps to save customers' time and money by minimizing potentially expensive piping reconfiguration (consult factory for details).

Technical Specifications

Operation and performance

Fluid types	Flare and vent gases
Pipe materials	All metals, fiberglass. Consult Panametrics for other materials
Flow accuracy (velocity)	Dependent on pipe diameter, and gas species. See table below for more information

Electronics

Flow measurement	Patented correlation transit-time mode
Enclosures	• Standard: Epoxy-coated aluminum and copper free weatherproof Type 4X/IP66 • Can be configured for Class I, Division 2, Groups ABCD, NEC & CEC • Optional: Stainless steel, weatherproof Type 4X/ IP66 Can be configured for Class I, Division 2, Groups ABCD, NEC & CEC • Explosion proof Class I, Division 1, Groups BCD, NEC & CEC Ex d IIC T6 Gb, IECEx & ATEX (II 2G)
Dimensions (h x d)	Standard: Size 8.2 in x 6.6 in (208 mm x 168 mm)
Weight	10 lb (4.5 kg)
Channels	• Standard: One or two channels • Optional: Up to 4 channels (consult factory)
Display	Display 128 x 64 mono-color LCD display, configurable for single or dual measurement parameters
Keypad	Built-in magnetic, six-button, lockable keypad
Power supplies	• Standard: 100-240 VAC ±10% • Optional: 12 to 28 VDC, ±5% Note: For DC-powered meters, Class 2 rated supplies must be used for the line power.
Power consumption	15 W maximum

Temperature range

Operating temperature	-40°F to 149°F (-40°C to 65°C) except when Foundation Fieldbus option is selected (G= 3 or 4); in this case, the operating temperature is -40°F to 140°F (-40°C to 60°C)
Storage temperature	–67F° to 167°F (–55°C to 75°C)
Standard inputs/outputs	• One isolated digital output, active or passive, may be configured as either alarm, pulse or frequency output • One 4 to 20 mA isolated output, 600 Ohm maximum load, NAMUR NE43
Optional inputs/outputs	• One additional isolated digital output, active or passive, may be configured as either alarm, pulse or frequency output • Two additional 4 to 20 mA isolated outputs, active, 600 Ohm maximum load, NAMUR NE43 • One or two 4 to 20 mA isolated inputs, passive or active 24-VDC loop power, NAMUR NE43 • One or two isolated, three-wire RTD (temperature) inputs, –148°F to 662°F (–100°C to 350°C), 100 Ohm or 1000 Ohm platinum • One or two isolated, four-wire RTD (temperature) inputs, –148°F to 662°F (–100°C to 350°C), 100 Ohm or 1000 Ohm platinum
Digital interfaces	Standard: RS485 (Modbus), Ethernet 10/100 Mbits/s (Panaview Plus Web Server) • Optional: HART® 7 protocol, with 4 dynamic variables, includes one additional 4 to 20 mA analog output • Optional: Foundation Fieldbus® FISCO, LAS capable, Namur NE107 compliant with # Blocks
European complies with	• 2014/30/EU EMC - Industrial EM Environments • 2014/35/EU LVD - Equipment Class I, Pollution Degree 2,Overvoltage Category II • 2014/34/EU ATEX (optional) - II 2G • The XGF1100 is intended for inclusion in large-scale fixed installations (LSFI) and are therefore outside of the scope of Directive 2011/65/EU RoHS

T5MAX wetted flow ultrasonic transducers

Temperature range	Normal Temperature (NT): -55°C to 150°C
Pressure range	Standard: -2 psig to 1500 psig (87.6 to 10300 kPa)
Transducer material	Standard: Titanium, Hastelloy® alloys or SS316 (Monel® Consult factory)
Process connections	Flanged and compression fittings
Hazardous area classifications	Explosive-proof Class I, Division 1, CD Optional: Group B upon request Ex d IIC T4.T3 or T2 Gb, IECEx & ATEX (II 2G) An integrated XAMP preamplifier may be installed in the certified assembly

T5/T17 wetted ultrasonic flow transducers

Temperature range	• Normal Temperature (NT): -55°C to 150°C • Low Temperature (LT): -220°C to 100°C • High Temperature (HT): -50°C to 250°C • Extremely High Temperature (XT): -180°C to 300°C
Pressure range	Standard: -2 psig to 1500 psig (87.6 to 10300 kPa)
Transducer material	• Standard: Titanium • Optional: Monel® or Hastelloy® alloys or SS316
Process connections	Flanged and compression fittings
Hazardous area classifications	Explosion proof Class 1, Division 1, Group C, D Optional: Group B upon request ATEX II 2 G Ex db IIC T6...T2 Gb IP66 IECEx Ex db IIC T6...T2 Gb IP66

Insertion mechanism

Standard and extended range	1.5 inch (38 mm), 2 inch (50 mm) and 3 inch (76mm) mounted packing gland and valve

Preamplifier

In-line XAMP preamplifier with BNC connections; one per transducer.

Gain	• Standard: 20 and 40 • Optional: 2, 10 (factory selected)
Preamp temperature range	-40°C to +60°C (-40°F to +140°F)

Location

Installation of the XAMP in the transducer assembly is covered by the transducer's hazardous area certification, subject to the above temperature limits.

Alternately, the XAMP may be installed separate from the transducer – remote mounted – with the following rating.

Explosion-proof Class I, Division 1, CD or BCD Ex d IIC T6 Gb, IECEx & ATEX (II 2G) h (38 mm), 2 inch (50 mm) and 3 inch (76mm) mounted packing gland and valve

Transducer cables

- Standard: (per pair of transducers)
  One pair of coaxial cables, type RG62 A/U, preamplifier to XGF1100 electronics, lengths 3 m (10 ft) to 330 m (1000 ft) maximum
- Optional: flame retardant, armored cable and fire resistant

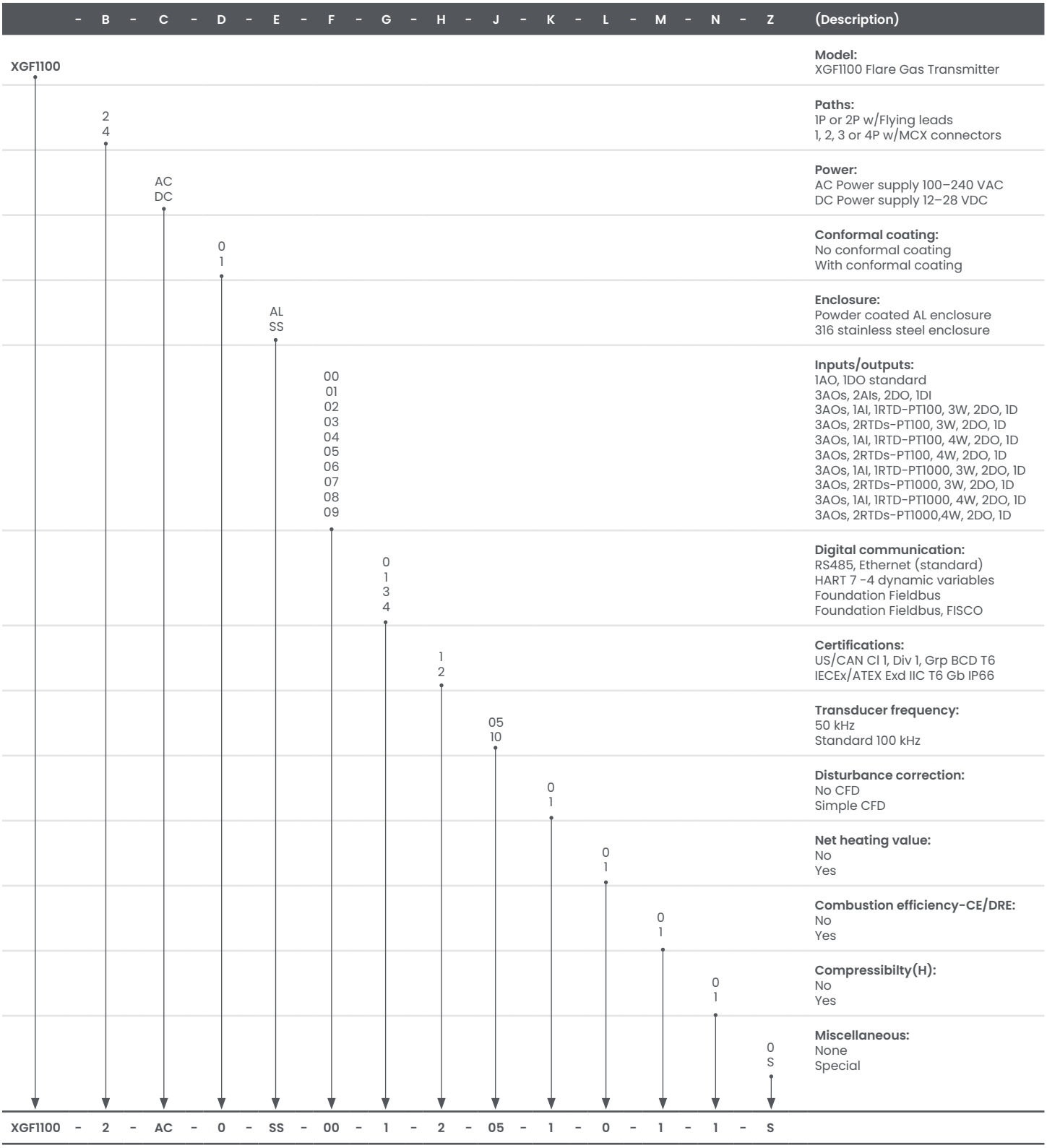
Additional options

PanaView Plus PC-interface software
The XGF1100 communicates with a PC through a web server and Windows® operating systems. Features include site files, logs and other operations with a PC.

Installation flowcells

Transducers and flowcells for specific applications are available. Consult Panametrics for details.

PanaFlare XGF1100 part number



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Flow Accuracy

Tranducer Type	T5/T5MAX Wetted Transducer		T17/T5MAX 180 Degree Head (see note 1)	
	Flow Measurement Range			
Standard Range	-328 to 328 ft/s (-100 to 100 m/s) – bidirectional			
Extended Range	0.1 to 394 ft/s (0.03 to 120 m/s) – non-bidirectional			
	Applicable Pipe Sizes			
Diagonal 45	3 in to 14 in (80 to 350 mm)		14 in to 120 in (350 to 3000 mm)	
Bias 90	10 in to 120 in (250 to 3000 mm)		Not Applicable	
	Design Velocity Accuracy from 1 to 394 ft/s (0.3 to 120 m/s) refer to notes [2,3,4]			
	1 ft/s (0.3 m/s)	>3 ft/s (1 m/s)	1 ft/s (0.3 m/s)	>3 ft/s (1 m/s)
Pipe Dia <6 in (150 mm)	±1.5% to ±2.5%	±1.5% to ±2.0%	NA	NA
Pipe Dia >/= 6 in (150 mm)	±1.5% to ±2.0%	±1.5% to ±2.0%	±1.5% to ±2.0%	±1.5% to ±2.0%
	Calibrated Velocity Accuracy from 1 to 394 ft/s (0.3 to 120m/s, n=# of paths) refer to notes [2,3,4]			
	1 ft/s (0.3 m/s)	>3 ft/s (1 m/s)	1 ft/s (0.3 m/s)	>3 ft/s (1 m/s)
Pipe Dia <6 in (150 mm)	±1.5%/$\sqrt{n}$	±1.0%/$\sqrt{n}$	NA	NA
Pipe Dia >/= 6 in (150 mm)	±1.0%/$\sqrt{n}$	±1.0%/$\sqrt{n}$	±1.0%/$\sqrt{n}$	±1.0%/$\sqrt{n}$
	Mass Flow Accuracy			
	±2.0% to ±3.0%			
	Molecular Weight Accuracy			
2 to 120 kg/kmol	±1.8% to ±2.0%			
	Net Heating Value (NHV) Accuracy refer to note [5]			
	±2.0% to ±5.0%			
	Flow Velocity Sensitivity (in/s) from 0.1 to 1 ft/s (0.03 to 0.3 m/s) refer to notes [2,6]			
Pipe Dia = 20 in (500 mm)	±0.023/$\sqrt{n}$		±0.010/$\sqrt{n}$	

Notes:
1. T17 is available in NT/HT/LT/XT; T5MAX is only available in NT. T5/T5MAX are available in both Bias 90 and Diagonal 45 configurations while T17 is only available in Diagonal 45 configuration.
2. Accuracy and sensitivity are dependent on pipe diameter, molecular weight and temperature. All accuracy specs assume molecular weight greater than 24 kg/kmol and temperature less than 100°F (38°C). For specific application, expected meter performance is determined by flow meter sizing tool.
3. All accuracy specs assume a fully developed flow profile. This typically requires 20D upstream and 5D downstream. Desired accuracy can also be achieved with shorter straight runs as little as 5D upstream and 2D downstream through correction factors from Computational Fluid Dynamics (CFD) analysis loaded to meter. Consult factory for details.
4. Multipath configuration generally improves meter accuracy and makes meter more robust.
5. Assume known N2 concentration. Accuracy is typical. Consult factory for details.
6. Estimations are based on 12.9 in path length for Bias 90 configuration, and 28.3 in path length for Diagonal 45 configuration for 20 in pipe size.

Repeatability

±0.5% at 1 to 394 ft/s (0.3 m/s to 120 m/s). Consult factory for details.

General installation straight run requirement

20D upstream and 5D downstream without CFD analysis. 5D upstream and 2D downstream with CFD analysis. Consult factory for details.

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PANA100DS_R2 (04/2026)

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