FLUENTA

Document number: 72.120.308
Document title: FGM 160 Data Sheet

Scope:	ISO 9001:2015 §8.2 Requirements for products and services

Additional Information (when applicable):

Any update to this document must be followed by translation into Portuguese and update of the document 72.120.336

Rev. index	Issue date	Reason for issue	Author	Review	Review	Review by QA	Approved
H	2020.12.17	Updated to include Dual-Path & table names updated	SPA	ST	-	KO	ST
G	2020.06.08	Updated to include Inmetro, ECASEx and IECEX certification numbers	SPA	MB	-	MB	NB
F	2019.11.08	Updated maximum optional temperature for TFS Sensors in Operating Temperature table	SPA	ST	-	KO	KO
E	2018.08.22	Updated to TFS series, and for UFM Manager. Terminology adjusted.	AK	NB	MR	MM	MM
D	2016.01.05	Temp. spec. corrected	JR	AH	-	MW	MW
C	2014.01.14	Proofread and updated	AP	CT	KH	MW	DJ
B	2013.01.25	Removed from User Manual, updated: list of tables added, text formatting	MKJ	KH	-	MW	MW
A	2008.03.12	Issued for Fluenta release, moved to User Manual	MS	HAa	-	N/A	AAJ

Replacement for:	**n/a**	Total pages: **7**
Fluenta source doc. (for translations):	**n/a**	

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1. PURPOSE

This document specifies the general, environmental, electrical and operational data of the Fluenta Flare Gas Meters, FGM 160 and FGM 160 Dual-Path.

2. ABBREVIATIONS/DEFINITIONS

2.1 Abbreviations

TFS	Transducer Full Size
ID	Inner Diameter
DCS	Distributed Control System

2.2 Definitions

FGM160	Fluenta FGM160 flare gas meter (single pair of sensors)
FGM160 Dual-Path	Fluenta FGM 160 flare gs meter (two pairs of sensors)
Ex-d/e	FGM160 Flare Gas Meter Electronics Unit in Ex-d explosion proof enclosure and connection housing in Ex-e enclosure.
Ex-d	FGM160 Flare Gas Meter Electronics Unit and connection housing in Ex-d explosion proof enclosure.
TFS Series	Ultrasonic sensors based on the TFS. See document 72.050.001 for details on this range
Transducer	The term 'Transducer' is used interchangeably with 'Sensor' in the context of the FGM160.

3. GENERAL

Table 1: FGM160 and FGM160 Dual-Path General

<table>
<tr><td>3.1</td><td>Sensor Type</td><td colspan="2">Ultrasonic / Time-of-flight / TFS Series / Wetted but non-intrusive</td></tr>
<tr><td>3.2</td><td>Sensor Material</td><td>STANDARD</td><td>OPTIONAL</td></tr>
<tr><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4">SS316 / Titanium</td><td>Titanium / Inconel</td></tr>
<tr><td>Titanium / Hastelloy</td></tr>
<tr><td>Titanium / 6Mo</td></tr>
<tr><td>Titanium / Duplex</td></tr>
<tr><td rowspan="5">3.3</td><td rowspan="5">Certification Flare Gas Meter</td><td colspan="2">ATEX: Nemko 07ATEX1160</td></tr>
<tr><td colspan="2">CSA: CSA2241432 - Class I Div 2</td></tr>
<tr><td colspan="2">ECASEx: 20-01-02264/E20-01-001542</td></tr>
<tr><td colspan="2">Inmetro: DNV 14.0024 X</td></tr>
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<tr><td></td><td>Flare Gas Meter</td><td colspan="2">Ex de [ia] IIC T6, Tamb: -40 °C to + 60 °C</td></tr>
<tr><td></td><td>Ultrasonic Sensors</td><td colspan="2">Ex ia IIC T4-T6 (Zone 0)</td></tr>
<tr><td>3.4</td><td>Service</td><td colspan="2">Flare Gas Measurement and other low pressure hydrocarbon gas flow measurements</td></tr>
</table>

4. OPERATING LIMITS

Table 2: FGM160 Operating limits

4.1	Pipe Sizes	STANDARD	OPTIONAL
		2" to 72"	74" to 82"
4.2	Temperature		
	Ambient Temperature (Flare Gas Meter)	-40 to +140 °F (-40 to +60 °C)	
	Operating Temperature (TFS Sensors)	-94 to +293 °F (-70 to +145 °C) *)	-166 to 392 °F (-110 to +180 °C)
4.3	Operating Pressure	11.6 - 145 psiA (0.8 to 10 barA)	

*): Temperatures lower than -70 °C for short periods of time.

Table 3: FGM160 Dual-Path Operating Limits

4.1	Pipe Sizes	STANDARD	OPTIONAL
		12" to 72"	2” to 12” and 74" to 82"
4.2	Temperature		
	Ambient Temperature (Flare Gas Meter)	-40 to +140 °F (-40 to +60 °C)	
	Operating Temperature (TFS Sensors)	-94 to +293 °F (-70 to +145 °C) *)	-166 to 392 °F (-110 to +200 °C)
4.3	Operating Pressure	11.6 - 145 psiA (0.8 to 10 barA)	

*): Temperatures lower than -70 °C for short periods of time.

5. DESIGN LIMITS

Table 4: FGM160 and FGM160 Dual-Path Design limits

5.1	Design Pressure	290 psiA (20 barA)*)

*): Mechanical survival ratings, NOT operational survival ratings.

6. ELECTRICAL DATA

Table 5: FGM160 and FGM160 Dual-Path Electrical data

6.1	Supply Voltage	STANDARD	OPTIONAL
		24 VDC (20 - 32 VDC)	AC/DC converter in Exd enclosure, sunshade included
6.2	Power Consumption	13 VA max	
6.3	Input Signal	Time of flight: from ultrasonic sensors	
		Temperature & Pressure: analog 4-20 mA or digital HART communication	
6.4	Output Signal	STANDARD	OPTIONAL
		6 x analog 4-20 mA outputs HART output Pulse / frequency signal RS422 / RS485, 2- or 4- wire Modbus Protocol, RTU	Foundation Fieldbus TCP/IP via Ethernet SoftFlow
		Each output channel can individually be set to one of the following: • Volume flowrate at reference conditions • Volume flowrate at line conditions • Mass flow • Density at standard conditions • Density at operational conditions • Molecular weight • Alarm High • Alarm Low • Temperature • Pressure	
6.5	Frequency Output	1 x Frequency outputs. f_{max} = 2 kHz	
6.6	Pulse Output	1 x Pulse output (max 250 pulses/s)	
6.7	Serial Link to DCS	RS422 / RS485, 2- or 4-wire	
		Modbus protocol, ASCII or RTU	
6.8	Foundation Fieldbus Interface	1 x FF Output (4 variables) *)	
6.9	Serial link to O&SC	RS485, 2- or 4-wire	
		Modbus protocol, RTU	

*): disables DCS and analog 4-20 mA communication

7. FUNCTIONAL CHARACTERISTICS

Table 6: FGM160 and FGM160 Dual-Path Functional characteristics

7.1	Flow Velocity Range	0.1 - 394 ft/s (0.03 - 120 m/s)	
7.2	Accuracy	STANDARD	OPTIONAL
		+/- 2.5% to 5%	+/- 0.75% to 2%
7.3	Resolution	0.003 ft/s (0.0008 m/s)	
7.4	Repeatability	Better than 1% of volume flow for velocity 0.3 - 100 m/s (1 - 328 ft/s)	
7.5	Turn Down Ratio	4000:1	
7.6	Calibration	Zero flow calibration *)	
	Measurement Parameters	Standard and actual volume flow, mass flow, totalized standard volume flow, totalized mass flow, molecular weight, standard density, actual density, pressure, temperature, speed of sound, gas velocity	

*): Wet (flow) calibration on third-party rig for improved measurement accuracy can be offered.

8. MEASURING SECTION

Table 7: FGM160 and FGM160 Dual-Path Measuring section

8.1	Material Wetted Parts	Stainless steel 316L (Nace MR 0-175) or to customer's specification
8.2	Ball Valves	2" 150# RF Full bore to customer specification
8.3	Upstream Straight Pipe Requirements	10 x ID (20 x ID: Norwegian Petroleum Directorate regulation)
8.4	Downstream Straight Pipe Requirements	5 x ID (8 x ID: Norwegian Petroleum Directorate regulation)
8.5	Dimensions	Sensor length: TFS Series In operation: 0.71 m (2.33 ft) Retracted: 1.03 m (3.38 ft) FGM160 Sensor Cable length: up to 167 ft (51 m) FGM160 Dual-Path Cable Length: up to 30m
8.6	Installation	45° angle: centre line sensors / run pipe
	FGM160	Sensors: 6"- 10" → pipe: 42° / 48°,
		12"- 72" → pipe: 45° / 45°
	FGM160 Dual-Path	Sensor angles: either 42° / 48°, or 45° / 45° depending on pipe diameter (see note 6.1)
	FGM160 & FGM160 Dual-Path	Special metering / welding jigs to be used during installation of sensor holders

Note 6.1: the installation angle of the ultrasonic sensor is either 42°/48°, or 45°/45° depending on the diameter of the pipe and offset (from the diameter) of the ultrasonic paths in the pipe. Typically for smaller pipes (up to 12" to 14") angles of 42°/48° are used, and for larger pipe sizes 45°/45° are used. See document 62.120.001 for details.

9. FLARE GAS METER

Table 8: FGM160 and FGM160 Dual-Path Flare Gas Meter:

9.1	Installation	Ex-d/e enclosure
9.2	Local Display	Parameter viewing of predefined set of process parameters *)
9.3	Dimensions	Ca. 280 x 470 x 290 mm (W x H x D)
9.4	Weight	Approx. 16 kg

*): Predefined parameter set;

- Volume flow rate at actual (flow) conditions
- Mass flow rate at actual (flow) conditions
- Totalized volume flow
- Totalized mass flow
- Last 24h totalized mass flow
- Pressure
- Temperature

10. UFM MANAGER

Table 9: UFM Manager

10.1	Basic Level	System Configuration	Changes basic system settings – changing units of measurement or synchronising the time another machine
10.2	Basic Level	Data Logging	The logging and storing of historical data
10.3	Operator Level	Graphs and live data	Access to FGM160 signal quality graphs
10.4	Operator Level	Input configuration	Configuration of all inputs available in the flow meter: pressure and temperature using HART, 4-20, Modbus or fixed values
10.5	Operator Level	Modbus configuration	Configuration of the Modbus interface for DCS port. Service port configuration cannot be changed here
10.6	Operator Level	Analogue outputs	Selection of variables available on one of six analogue outputs and calibration of 4-20mA outputs
10.7	Operator Level	Other outputs	Configuration of all other outputs available in FGM 160, including frequency, pulse and HART
10.8	Operator Level	Flow meter alarms	Settings for measurement critical values that should initiate alarms in the flow meter