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1. PURPOSE

This document specifies the general, environmental, electrical and operational data of the Fluenta Flare Gas Meter, FGM 160.

2. ABBREVIATIONS/DEFINITIONS

2.1 Abbreviations

TFS	Transducer Full Size
ID	Inner Diameter
DCS	Distributed Control System
O&SC	Operator & Service Console

2.2 Definitions

EEx-d/e	FGM160 Field Computer Electronics Unit in EEx-d explosion proof enclosure and connection housing in EEx-e enclosure.
EEx-d	FGM160 Field Computer Electronics Unit and connection housing in EEx-d explosion proof enclosure.

3. GENERAL

Table 1: General

3.1	Transducer Type	Ultrasonic / Time-of-flight / TFS / Wetted but non-intrusive	
3.2	Transducer Material	STANDARD	OPTIONAL
		SS316 / Titanium	Titanium / Inconel
			Titanium / Hastelloy
			Titanium / 6Mo
			Titanium / Duplex
3.3	Certification	ATEX: Nemko 07ATEX1160	
		CSA: CSA2241432 - Class I Div 2	
	Field Computer	Ex de [ia] IIC T6, Tamb: -40 °C to + 60 °C	
	Ultrasonic Transducers	Ex ia IIC T4-T6 (Zone 0)	
3.4	Service	Flare Gas Measurement and other low pressure hydrocarbon gas flow measurements	

4. OPERATING LIMITS

Table 2: Operating limits

4.1	Pipe Sizes	STANDARD	OPTIONAL
		2" to 72"	74" to 82"
4.2	Temperature		
	Ambient Temperature (Field Computer)	-40 to +140 °F (-40 to +60 °C)	
	Operating Temperature (Transducers)	-94 to +293 °F (-70 to +145 °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 3: Design limits

5.1	Design Temperature (Transducers)	-238 to +599 °F (-150 to +315 °C) *)
5.2	Design Pressure	290 psiA (20 barA) *)

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

6. ELECTRICAL DATA

Table 4: 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 transducers	
		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

		<p>Each output channel can individually be set to one of the following:</p> <ul style="list-style-type: none"> • 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 5: 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%	+/- 1% 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 6: 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	Transducer length: Transducer Full Size - TFS; In operation: 0.71 m (2.33 ft) Retracted: 1.03 m (3.38 ft) Transducer Cable length: up to 167 ft (51 m)
8.6	Installation	45° angle: centre line transducers / run pipe
		Transducers: 6"- 10" → pipe: 42° / 48°,
		12"- 72" → pipe: 45° / 45°
		Special metering / welding jigs to be used during installation of transducer holders

9. FIELD COMPUTER

Table 7: Field computer

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. OPERATOR CONSOLE

Table 8: Operator console

10.1	System View	Single System View; detailed data view, trend log, configuration
10.2	Software upload	Via integrated Service Console*
10.3	Remote Operation	Via RS485-TCP/IP interface or Remote Control Software

*: Only available for Fluenta personnel