

Design Features

- Supports up to 23 Engineering Units (including User Defined).
- Stores calibration data for up to 10 gases.
- Programmable Totalizer indicates total gas quantity.
- High and low gas flow Alarm limits with preset delay interval.
- Two sets of user-programmable electromechanical SPDT relays with latch option.
- User-selectable analog 0-5 Vdc or 4-20mA outputs.
- Internal Conversion factors for up to 32 gases.
- Digital Interface (RS-232 / RS-485, Profibus DP available).
- Multi-Drop Capability of up to 256 units (RS-485 option).
- Optional Profibus DP interface with I&M functionality.
- Automatic sensor zero offset adjustment (via digital interface or local push button).
- Self-Diagnostic Tests.
- Local 2 x 16 characters LCD display* with adjustable back light (optional).



^{*} LCD display is not available for Profibus DP interface option.



XFM Digital Mass Flow Meters

The flow rate can be displayed in 23 different volumetric flow or mass flow engineering units including user specific. Flow meters can be programmed remotely via RS-232 /RS-485 or optional Profibus DP interface.

XFM flow meters support various functions including: programmable flow totalizer, high and low flow alarm, automatic zero adjustment, 2 relay outputs, jumper selectable 0-5 Vdc or 4-20 mA analog outputs, status LED diagnostic, capable to store calibration for up to 10 different gases. internal or user-specific K-factors. Optional local 2 x 16 characters LCD display* with adjustable back light provides Flow, Total and diagnostic reading simultaneously.

Principle Of Operation

The stream of gas entering the Mass Flow transducer is split by shunting a small portion of the flow through a capillary stainless steel sensor tube. The remainder of the gas flows through the primary flow conduit. The geometry of the primary conduit and the sensor tube are designed to ensure laminar flow in each branch. According to principles of fluid dynamics, the flow rates of a gas in the two laminar flow conduits are proportional to one another. Therefore, the flow rates measured in the sensor tube are directly proportional to the total flow through the transducer. In order to sense the flow in the sensor tube, heat flux is introduced at two sections of the sensor tube by means of precision-wound heater sensor coils. Heat is transferred through the thin wall of the sensor tube to the gas flowing inside. As gas flow takes place, heat is carried by the gas stream from the upstream coil to the downstream coil windings.

The resultant temperature dependent resistance differential is detected by the electronic control circuit. The measured temperature gradient at the sensor windings is linearly proportional to the instantaneous rate of flow taking place. An output signal is generated that is a function of the amount of heat carried by the gases to indicate mass molecular based flow rates. Additionally, the XFM model Mass Flow Meter incorporates a Precision Analog Microcontroller (ARM7TDMI® MCU) and non-volatile memory that stores all hardware specific variables and up to 10 different calibration tables.

Interface

The digital RS485 or RS-232 interface (optional Profibus DP interface is available) provides access to applicable internal data including: flow, CPU temperature, auto zero, totalizer and alarms settings, gas table, conversion factors and engineering units selection, dynamic response compensation and linearization table adjustment. The analog interface provides 0 to 5Vdc or 4 to 20 mA (jumper selectable) outputs for flow reading.

Auto Zero

The XFM supports automatic sensor zero offset adjustment which can be activated locally via the maintenance push button or remotely via digital interface. The auto zero feature necessitates a condition of absolutely no flow through the meter during the adjustment process. Provisions are made to either start, read, or save the current auto zero value via digital commands.

Totalizer

The total volume of the gas is calculated by integrating the actual gas flow rate as a function of time.

THE DIGITAL INTERFACE COMMANDS ARE PROVIDED TO:

- SET THE TOTALIZER TO ZERO.
- START THE TOTALIZER AT A PRESET FLOW.
- ASSIGN ACTION AT A PRESET TOTAL VOLUME.
- START/STOP TOTALIZING THE FLOW.
- READ TOTALIZER.

Totalizer conditions become true when the totalizer reading and the "Stop at Total" volumes are equal. In addition, the provision is made to automatically disable Totalizer during sensor warm up period.

Flow Alarm

High and Low gas flow ALARM limits can be preprogrammed via digital interface. ALARM conditions become true when the current flow reading is equal or higher/lower than corresponding values of high and low alarm levels. Alarm action can be assigned with preset delay interval (0-3600 seconds) to activate the contact closer (separate for High and Low alarm). Latch Mode control feature allows each relay to be latched on or follow the corresponding alarm status.

^{*} LCD display is not available for Profibus DP interface option.



DIGITAL MASS FLOW METER

TABLE T OBEOLESOATIONS								
TABLE 7 - SPECIFICATIONS								
FLOW MEDIUM:	Please note that XFM Mass Flow Meters are designed to work only with clean gases. Never try to measure flow rates of liquids with any XFM.							
CALIBRATIONS:	Performed at standard conditions [14.7 psia (101.4 kPa) and 70 °F (21.1 °C)] unless otherwise requested.							
ENVIRONMENTAL (PER IEC 664):	Installation Level II; Pollution Degree II.							
FLOW ACCURACY	±1% of FS at calibration temperature and pressure.							
REPEATABILITY:	±0.15% of full scale.							
FLOW TEMPERATURE COEFFICIENT:	0.15% of full scale/ °C or better.							
FLOW PRESSURE COEFFICIENT:	0.01% of full scale/psi (6.895 kPa) or better.							
FLOW RESPONSE TIME:	600ms time constant; approximately 2 seconds to within ±2% of set flow rate for 25% to 100% of full scale flow.							
MAXIMUM GAS PRESSURE:	XFM07/17/37/47: 1000 psig (6894 kPa gage) XFM57/67/77: 500 psig (3447 kPa gage)							
MAXIMUM PRESSURE DROP:	0.18 PSID (at 10 L/min flow). 4 psi (at 50 L/min flow). See Table 10 for pressure drops associated with various models and flow rates.							
GAS AND AMBIENT TEMPERATURE:	32 °F to 122 °F (0 °C to 50 °C). 14 °F to 122 °F (-10 °C to 50 °C) - Dry gases only.							
RELATIVE GAS HUMIDITY:	Up to 70%.							
LEAK INTEGRITY:	1 x 10 ⁻⁹ smL/sec He maximum to the outside environment.							
ATTITUDE SENSITIVITY:	Deviation of up to 1% from stated accuracy, after re-zeroing.							
OUTPUT SIGNALS:	Linear 0-5 Vdc (3000 ohms min load impedance); Linear 4-20 mA (500 ohms maximum loop resistance). Maximum noise 20mV peak to peak (for 0-5 Vdc output).							
CONNECTIONS:	 XFM 07: 1/8" compression fittings. Optional: 1/4" compression fittings. XFM 17: 1/4" compression fittings. Optional: 1/8", 3/8", 6 mm compression fittings, 1/4" VCR. XFM 37: 1/4" compression fittings. Optional: 3/8", 6 mm compression fittings, 1/4" VCR. XFM 47: 3/8" compression fittings. XFM 57: 3/8" compression fittings. XFM 67: 1/2" compression fittings. XFM 77: 3/4" FNPT. Optional: 3/4" compression fittings. 							
TRANSDUCER INPUT POWER:	11 to 26 Vdc, 100 mV maximum peak to peak output noise. Power consumption: +12Vdc (200 mA maximum); +24Vdc (100 mA maximum); Circuit board have built-in polarity reversal protection, 300mA resettable fuse provide power input protection.							
	Aluminum Models: Anodized aluminum, brass, 316 stainless steel, FKM O-rings.							
** FLUID CONTACT:	Stainless Steel Models: 316 stainless steel, FKM O-rings.							
	Optional O-ring Materials: Buna-N®, EPR® (Ethylene Propylene), or FFKM.							
CAUTION:	Aalborg makes no expressed or implied guarantees of corrosion resistance of mass flow meters as pertains to different flow media reacting with components of meters. It is the customers' sole responsibility to select the model suitable for a particular gas based on the fluid contacting (wetted) materials offered in the different models.							
DISPLAY:	*Optional local 2x16 characters LCD with adjustable backlight (2 lines of text).							
CALIBRATION OPTIONS:	Standard is one 10 points NIST traceable calibration. Optional, up to 9 additional calibrations may be ordered at additional charge.							
CE COMPLIANCE:	EMC Compliance with 89/336/EEC as amended. Emission Standard: EN 55011:1991, Group 1, Class A Immunity Standard: EN 55082-1:1992.							

^{*} LCD display is not available for Profibus DP interface option.

^{**}The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.



Multi-Gas Calibration

The XFM is capable of storing primary calibration data for up to 10 gases. This feature allows the same XFM to be calibrated for multiple gases while maintaining the rated accuracy on each.

Conversion Factors

Conversion factors for up to 32 gases are stored in the XFM. In addition, provision is made for a user-defined conversion factor. Conversion factors may be applied to any of the ten gas calibrations via digital interface commands.

Contact Closure

Two sets of electromechanical SPDT relay outputs are provided to actuate user-supplied equipment.

These are programmable via digital interface such that the relays can be made to switch when a specified event occurs (e.g. when a low or high flow alarm limit is exceeded or when the totalizer reaches a specified value) or may be directly controlled by user.

TABLE	TABLE 8 - STANDARD FLOW CAPACITIES FOR XFM												
XFM 07	XFM 17	XFM 37	XFM 37 XFM 47		XFM 67	XFM 77							
mL/min [N2]	L/min [N2]	L/min [N2]	L/min [N2]	L/min [N2]	L/min [N2]	L/min [N2]							
5	1	20	60	200	500	1000							
10	2	30	80										
20	5	40	100										
50	10	50											
100													
200													
500													

TABLE 9 - MAXIMUM PRESSURE DROP FOR XFM										
MODEL	FLOW RATE	MAXIMUM PRESSURE DROP								
MODEL	[liters/min]	[mm H2O]	[psid]	[kPa]						
XFM 07	up to 0.5	130	0.18	1.275						
XFM 17	up to 10	130	0.18	1.275						
XFM 37	up to 50	2722	3.8	26.2						
XFM 47	up to 100	1974	11.8	81.4						
XFM 57	up to 200	2720	4.0	27.6						
XFM 67	up to 500	3400	5.0	34.5						
XFM 77	up to 1000	6120	9.0	62.0						

Leak Integrity

1 x 10⁻⁹ smL/sec of Helium maximum to the outside environment.

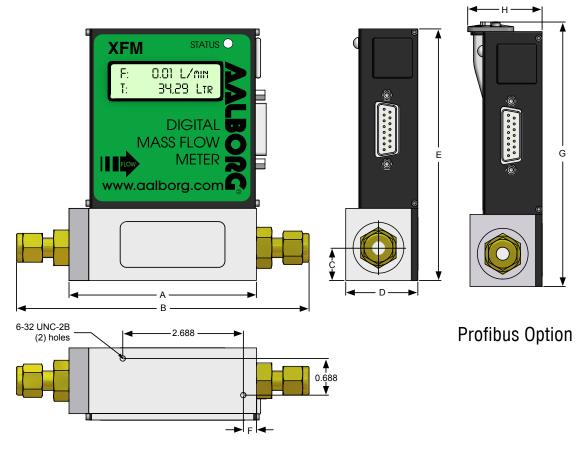
Engineering Units

The measured gas flow and associated totalizer data are scaled directly in engineering units via the digital interface.

THE FOLLOWING 23 UNITS OF MEASURE ARE SUPPORTED:

TABLE	10 - UNI	TS OF MEASUI	RE FOR XFM	
NUMBER	INDEX	FLOW RATE ENGINEERING UNITS	TOTALIZER ENGINEERING UNITS	DESCRIPTION
1	0	%	%s	Percent of full scale
2	1	mL/sec	mL	Milliliter per second
3	2	mL/min	mL	Milliliter per minute
4	3	mL/hr	mL	Milliliter per hour
5	4	L/sec	Ltr	Liter per second
6	5	L/ min	Ltr	Liter per minute
7	6	L/hr	Ltr	Liter per hour
8	7	m3/sec	m3	Cubic meter per second
9	8	m3/ min	m3	Cubic meter per minute
10	9	m3/hr	m3	Cubic meter per hour
11	10	ft3/sec	f3	Cubic feet per second
12	11	ft3/min	f3	Cubic feet per minute
13	12	ft3/hr	f3	Cubic feet per hour
14	13	g/sec	g	Grams per second
15	14	g/min	g	Grams per minute
16	15	g/hr	g	Grams per hour
17	16	kg/sec	kg	Kilograms per second
18	17	kg/min	kg	Kilograms per minute
19	18	kg/hr	kg	Kilograms per hour
20	19	Lb/sec	Lb	Pounds per second
21	20	Lb/min	Lb	Pounds per minute
22	21	Lb/hr	Lb	Pounds per hour
23	22	User	UD	User defined





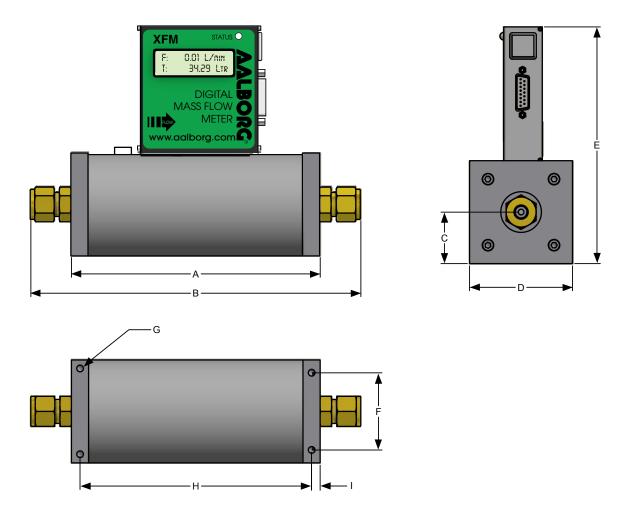
NOTE: Aalborg® reserves the right to change designs and dimensions at its sole discretion at any time without notice. For certified dimensions please contact Aalborg®.

TABLE 11 - D	TABLE 11 - DIMENSIONS FOR XFM [INCH]											
MODEL	*CONNECTION		PROFIBUS	PROFIBUS CAPABILITY								
MODEL	Compression Fitting (tube OD)	A	В	C	D	E	F	Н	ı			
XFM 07	1/4"	3.09	5.11	0.50	1.13	4.99	0.16	1.41	5.22			
XFM 17	1/4"	3.09	5.11	0.50	1.13	4.99	0.16	1.41	5.22			
XFM 37	1/4"	4.13	6.14	0.63	1.25	5.36	0.36	1.45	5.60			
XFM 47	3/8"	4.13	6.25	0.63	1.25	5.36	0.36	1.45	5.60			

TABLE 12 - D	TABLE 12 - DIMENSIONS FOR XFM [MM]											
MODEL	*CONNECTION	LCD and NO LCD VERSIONS PROFIBUS CAPABILITY										
MODEL	Compression Fitting (tube OD)	A	В	C	D	E	F	Н	I			
XFM 07	1/4"	78.6	129.7	12.7	28.6	126.6	4.0	35.9	132.6			
XFM 17	1/4"	78.6	129.7	12.7	28.6	126.6	4.0	35.9	132.6			
XFM 37	1/4"	104.8	156.0	15.9	31.8	142.4	9.2	38.6	142.4			
XFM 47	3/8"	104.8	158.8	15.9	31.8	142.4	9.2	38.6	142.4			

For optional fittings see ordering information.





NOTE: Aalborg* reserves the right to change designs and dimensions at its sole discretion at any time without notice. For certified dimensions please contact Aalborg*.

TABLE 13 - DIMENSIONS FOR XFM [INCH]										
MODEL	*CONNECTION	LCD and NO LCD VERSIONS								
MODEL	Compression Fitting (tube OD)	Α	В	C	D	E	F	Н	I	MOUNTING HOLES
XFM 57	3/8"	6.69	8.81	0.88	1.75	5.99	1.39	4.69	1.00	10-24 UNC
XFM 67	1/2"	7.25	9.62	1.50	3.00	6.90	2.25	6.75	0.25	1/4-20 UNC
XFM 77	3/4"	7.25	-	2.00	4.00	7.92	3.00	6.75	0.25	1/4-20 UNC

TABLE 14 - DIMENSIONS FOR XFM [MM]											
MODEL	*CONNECTION LCD and NO LCD VERSIONS									TABLE	
MODEL	Compression Fitting (tube OD)	A	В	C	D	E	F	Н	- 1	MOUNTING Holes	
XFM 57	3/8"	169.8	223.7	22.2	44.5	152.0	35.3	119.0	25.4	10-24 UNC	
XFM 67	1/2"	184.2	244.3	38.1	76.2	175.2	57.2	171.4	6.4	1/4-20 UNC	
XFM 77	3/4"	184.2	-	50.8	101.6	201.2	76.2	171.4	6.4	1/4-20 UNC	



DIGITAL MASS FLOW METER

TABLE 15 - XFM AC	CESSORIES
CBL-XFM	D-SUB F 15 pins connector with two 6 feet long branches with stripped ends for user supplied power supply and digital communication interface (no support for analog interface and relays). This cable is included with each instrument.
CBL-DGS	D-SUB F 15 pins connector with 6 feet long shielded cable (stripped ends). Can be used with user supplied power supply, allows access to all XFM peripherals. (Optional).
PS-XFM-110NA-2	Power Supply / cable assembly 110VAC NA PLUG 12Vdc with 6 feet long communication interface branch stripped ends (no support for analog interface and relays output). (Optional).
PS-XFM-110NA-2-A	Power Supply / cable assembly 110VAC NA PLUG 12Vdc with 6 feet long communication interface branch stripped ends with support for analog interface and relays output. (Optional).
PS-XFM-230EU-2	Power Supply / cable assembly 230VAC EU PLUG 12Vdc with 6 feet long communication interface branch stripped ends (no support for analog interface and relays output). (Optional).
PS-XFM-230EU-2-A	Power Supply / cable assembly 230VAC EU PLUG 12Vdc with 6 feet long communication interface branch stripped ends with support for analog interface and relays output. (Optional).
PS-XFM-240AU-2	Power Supply / cable assembly 240VAC AU PLUG 12Vdc with 6 feet long communication interface branch stripped ends (no support for analog interface and relays output). (Optional).
PS-XFM-240AU-2-A	Power Supply / cable assembly 240VAC AU PLUG 12Vdc with 6 feet long communication interface branch stripped ends with support for analog interface and relays output. (Optional).
PS-XFM-240UK-2	Power Supply / cable assembly 240VAC UK PLUG 12Vdc with 6 feet long communication interface branch stripped ends (no support for analog interface and relays output). (Optional).
PS-XFM-240UK-2-A	Power Supply / cable assembly 240VAC UK PLUG 12Vdc with 6 feet long communication interface branch stripped ends with support for analog interface and relays output. (Optional).

ORDERING INFORMATION DIGITAL MASS FLOW METER



Configure and Order Online: XFM Mass Flow Meter

XFM	MODEL							
	MAX FI	OW (N2)						
	07	0.5 L/min	1					
	17	10 L/min						
	37	50 L/min						
	47 57	100 L/mii 200 L/mii						
	67	500 L/mii						
	77	1000 L/m						
		MATERIA						
		A	Aluminum					
		S	Stainless St	ool				
		3	Stalliless St	ee i				
				SEALS				
					FKM			
				В	Buna®			
				E T	EPR PTFE / FI	IVN/		
				'				
					FITTING			MODEL
					A B	1/4" Comp 1/8" Comp		XFM 07, 17, 37 XFM 07, 17
					C	1/4" VCR®	16221011	XFM 17, 37
					D	3/8" Comp	ression	XFM 17, 37, 47, 57
					Е	1/2" Comp	ression	XFM 67
					F	3/4" FNPT		XFM 77
					G H	3/4" Comp 6mm Com		XFM 77 XFM 07, 17, 37
					П	OIIIIII COII	pression	AFW 07, 17, 37
						DISPLAY		
						N	NO Display	
						L	LCD Reado	out
							POWER	
							6 U	Iniversal 11 to 26 Vdc
								OUTPUT SIGNAL
								A 0-5Vdc B 4-20mA
								D 4-20IIIA
								DIGITAL INTERFACE
								2 RS232
								5 RS485
								9 PROFIBUS
XFM	17	S	_	V	Α	L	6	A 2
					4-0	1/410		

EXAMPLE: XFM17S-VAL6-A2 5 L/min [N₂] 20 psig **SPECIFY: Flow Range, Gas and Pressure**

XFM17 stainless steel, FKM seals, 1/4" compression fittings with LCD readout, 11 to 26 Vdc, 0-5 Vdc output signal with RS232 digital interface.