2. Technical data
2.1 CMF Series A Through F

Versions  *inch* *(N ominal)*		CMF- A $^1/_{16}$	CMF - B $^1/_8$	CMF - C $^1/_4$	CMF - D 1/2	CMF - E 1	CMF - F 2
Inside pipe diameter (Sensor consists of one continuous pipe)	*mm*	1.5	3.0	6.0	14.0	29.7	43.1
Pipe wall thickness	*mm*	0.25	0.5	1.0	1.0	2.0	2.6
Mass flow measuring range	*lb/min*	0-2.4	0-9.2	0-37	0-206	0-921	0-1916
	(kg/h)	(0-65)	(0-250)	(0-1,000)	(0-5,600)	(0-25,000)	(0-52,000)
Density	*g/cm³*	0.1-2.9					
Fraction e.g.	*°Brix*	0-100					
Temperature °C		-58 to 257°F	-58 to 356°F				
Standard		(–50 to +125)	(–50 to +180)				
High temperature version		-58 to 356°F (–50 to +180)					
Liquid pressure measuring pipe [1]							
Stainless steel	*psi*	4292	4277	4741	2291	1957	1812
	(bar)	(296)	(310)	(345)	(165)	(135)	(125)
Hastelloy C-22	*psi*	6670	5655	6235	3016	2769	2508
	(bar)	(460)	(390)	(430)	(208)	(191)	(173)
Materials							
Measuring pipe, flange-,		1.4435 (316 Stainless steel)					
Thread connection as standard		2.4602 (Hastelloy C-22)					
Enclosure and enclosure material		IP 65 and 1.4301 (Stainless steel)					
Enclosure, burst pressure	*psi*	1015	2755	2755	2030	1305	725
	(bar)	(70)	(190)	(190)	(140)	(90)	(50)
Process connections [2]							
Flange							
ANSI B16.5, Class 150				$^1/_2$"	$^1/_2$"	1"	$1^1/_2$"
ANSI B16.5, Class 600 (Class 300)				$^1/_2$"	$^1/_2$"	1 "	$1^1/_2$"
Clamp (PN 16) [3]							
ISO 2852/BS 4825 part 3 (SMS3016)				1"	1"	1"	2"
Thread							
ANSI/ASME B1.20.1, PN 100		$^1/_4$" NPT	$^1/_4$" NPT	$^1/_2$" NPT	$^1/_4$" NPT	1" NPT	2" NPT
Cable connection		Multiple plug connection to sensor $5 \times 2 \times 0.35$ mm² twisted and screened in pairs, ext. ∅ 12 mm					
Ex-version [4]		EEx ia II C T3-T6					
Weight approx.	*lbs*	5.7	9	18	27	106	106
	(kg)	(2.6)	(4)	(8)	(12)	(48)	(48)

1) Max. at 20 °C, DIN 2413, DIN 17457
2) Other connections to order, see chapter 9, ordering
3) Material, 1.4401 or corresponding
4) Intrinsically safe approval: CENELEC and ASEV

2.2.1 Mass Flowmeter Compact IP 67

	**Mass Flowmeter Compact IP 67**	
Measurement of	Mass flow [lb/min / kg/s], volume flow [gpm / [l/s], fraction [%], °Brix, density [kg/m^3], temperature [°F,°C]	
Current output		
Current	0-20 mA or 4-20 mA	
Load	< 800 ohm	
Time constant	0-30 s adjustable	
Digital output		
Frequency	0-10 kHz, 50% duty cycle	
Time constant	0-30 s adjustable	
Active	24 V d.c., 30 mA, 1 KΩ ≤ R_{load} ≤ 10 KΩ, short-circuit-protected	
Passive	3-30 V d.c., max. 110 mA, 1 KΩ ≤ R_{load} ≤ 10 KΩ	
Relay		
Type	Change-over relay	
Load	42 V / 2 A peak	
Functions	Error level, error number, limit, direction	
Digital input	11-30 V d.c. Ri = 13.6 KΩ	
Functionality	Start/hold/continue batch, 0-point adjust, reset totalizer 1/2, force output, freeze output	
Galvanic isolation	All inputs and outputs are galvanically isolated, isolation voltage 500 volts	
Cut-off		
Low-flow	0-9.9% of maximum flow	
Limit function	Mass flow, volume flow, fraction, density, sensor temperature	
Totalizer	Two eight-digit counters for forward, net or reverse flow	
Display	Background illumination with alphanumerical text, 3 × 20 characters to indicate flow rate, totalized values, settings and faults.	
	Reverse flow indicated by negative sign	
0-point adjustment	Manual via keypad or remote via digital input	
Ambient temperature	Operation: –20 to +50°C, max. rel. humidity 80% to 31°C decreasing to 50% at 40°C according to UL 3101	
	During storage: –40 to +70°C (Humidity max. 95%)	
Communication	Prepared for client mounted add-on modules	
Enclosure		
Material	Fiber glass-reinforced polyamide	
Rating	IP 67 to IEC 529 and DIN 40050 (1 m w.g. for 30 min.)	
Mechanical load	18-1000 Hz random, 3.17G rms, in all directions, to IEC 68-2-36	
Supply voltage	***24 V version***	***230 V version***
Supply	24 V d.c./a.c., 50-60 Hz	115/230 V a.c., 50-60 Hz
Fluctuation	24 V d.c., –25 to 25%	+10 to -10%
	24 V a.c., –16 to 25%	
Power consumption	10 W	26 VA
Fuse	230 V version: T400 mA, T 250V (IEC 127) - Not to be changed by user	
	24 V version: T1A, T 250V (IEC 127) - Not to be changed by user	
EMC performance	Emission EN 50081-1 (Light industry)	
	Immunity EN 50082-2 (Industry)	
Namur	Within the value limits according to "Allgemeine Anforderung" with error criteria A in accordance with NE 21	
Evironment	Environmental conditions acc. to UL 3101: Indoor use Altitude up to 2000 m POLLUTION DEGREE 2	
Maintenance	The flowmeter has a built-in error log/pending menu which should be inspected on a regular basis	

2.2.2 Mass Flowmeter 19" IP 20

	**Mass Flowmeter 19" IP 20**	
Measurement of	Mass flow [lb/min / kg/s], volume flow [gpm, l/s], fraction [%], °Brix, density [kg/m^3], temperature [°F, °C]	
Current output		
Current	0-20 mA or 4-20 mA	
Load	< 800 ohm	
Time constant	0-30 s adjustable	
Digital output		
Frequency	0-10 kHz, 50% duty cycle	
Time constant	0-30 s adjustable	
Active	24 V d.c., 30 mA, 1 KΩ ≤ R_{load} ≤ 10 KΩ, short-circuit-protected	
Passive	3-30 V d.c., max. 110 mA, 1 KΩ ≤ R_{load} ≤ 10 KΩ	
Relay		
Type	Change-over relay	
Load	42 V / 2 A peak	
Functionality	Error level, error number, limit, direction	
Digital input	11-30 V d.c., Ri = 13.6 KΩ	
Functionality	Start/hold/continue batch, zero point adjust, reset totalizer 1/2, force output, freeze output	
Galvanic isolation	All inputs and outputs are galvanically isolated, isolation voltage 500 volts	
Cut-off		
Low-flow	0-9.9% of maximum flow	
Limit function	Mass flow, volume flow, fraction, density, sensor temperature	
Totalizer	Two eight-digit counters for forward, net or reverse flow	
Display	Background illumination with alphanumerical text, 3 × 20 characters to indicate flow rate, totalized values, settings and faults.	
	Operation: -4 to 122°F (−20 to +50°C), max. rel. humidity 80% to 87°F (31°C) decreasing to 50% at 104°F (40°C) according to UL 3101.	
	During storage: -40 to 158°F (-40 to +70°C) (Humidity max. 95%)	
Communication	Prepared for client mounted add-on modules	
Enclosure		
Material	Standard 19" insert of aluminium/steel (DIN 41494)	
Dimensions	Width: 21 TE	
	Height: 3 HE	
Rating	IP 20 to IEC 529 and DIN 40050	
Load	Version: 1 G, 1-800 Hz sinusoidal in all directions, to IEC 68-2-6	
EMC performance	Emission EN 50081-1 (Light industry)	
	Immunity EN 50082-2 (Industry)	
Namur	Within the value limits according to "Allgemeine Anforderung" with error criteria A in accordance with NE 21	
Supply voltage	***24 V version***	***230 V version***
Supply	24 V d.c./a.c., 50-60 Hz	115/230 V a.c., 50-60 Hz
Fluctation	24 V d.c., −25 to 25%	+10 to -10%
	24 V a.c., −16 to 25%	
Power consumption	10 W	26 VA
Fuse	230 V version: T400 mA, T 250V (IEC 127) - Not to be changed by user	
	24 V version: T1A, T 250V (IEC 127) - Not to be changed by user	
Evironment	Environmental conditions acc. to UL 3101: Indoor use Altitude up to 6500 FT. (2000 m) POLLUTION DEGREE 2	
Ex approval	[EEx ia] IIC, DEMKO Ex 99E.125729X	

2.2.3 Transmitter 19" IP 20 with extended outputs

Transmitter 19" insert version with extended outputs	The Transmitter is also available in the 19" version with outputs increased to 3 current outputs, 2 digital outputs, 2 relay outputs, 1 digital input
	Other data is identical to the above

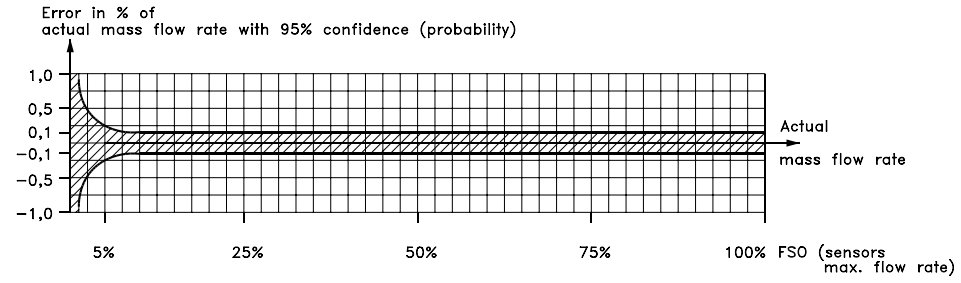
2.2.4 Transmitter Ex-d

	**Transmitter Ex-d**			
Measurement of	Mass flow [lb/min / kg/s], volume flow [gpm, l/s], fraction [%], °Brix, density [kg/m^3], temperature [°F, °C]			
Current output	Classified Ex ia, selectable as active or passive outputs. Default setting is passive mode			
Current	0-20 mA or 4-20 mA			
Load	< 350 ohm			
Time constant	0.1-30 s adjustable			
Output characteristics	***Active mode***		***Passive mode***	
(Terminals: 31-32)	U_o	24 V	U_i	30 V
	Io	115 mA	I_i	115 mA
	Po	0.7 W	P_i	0.7 W
	C_o	125 nF	C_i	52 nF
	L_o	2.5 mH	L_i	100 µH
Digital output				
Frequency	0-10 kHz, 50% duty cycle			
Time constant	0.1-30 s adjustable			
Passive	6-30 V d.c., max. 110 mA, 1 KΩ ≤ R_{load} ≤ 10 KΩ			
Output characteristics	***Active mode***		***Passive mode***	
(Terminals: 56-57-58)	Not available		U_i	30 V
			I_i	115 mA
			P_i	0.7 W
			C_i	52 nF
			L_i	100 µH
Relay				
(Terminals: 44-45-46)				
Type	Change-over relay			
Load	30 V / 100 mA			
Functionality	Error level, error number, limit, direction			
Output characteristics	U_i: 30 V, I_i: 100 mA, C_i: 0 nF, L_i: 0 mH			
Digital input				
(Terminals: 77-78)	11-30 V d.c., Ri = 13.6 KΩ			
Functionallity	Start/hold/continue batch, zero point adjust, reset totalizer 1/2, force output, freeze output			
Output characteristics	U_i: 30 V, I_i: 4.8 mA, P_i: 140 mW, C_i: 0 nf L_i: 0 mH			
Galvanic isolation	All inputs and outputs are galvanically isolated, isolation voltage 500 volts			
Cut-off				
Low-flow	0-9.9% of maximum flow			
Empty pipe	Detection of empty sensor			
Density	0 - 2.9 g/cm^3			
Totalizer	Two eight-digit counters for forward, net or reverse flow			
Display	Background illumination with alphanumerical text, 3 × 20 characters to indicate flow rate, totalized values, settings and faults.			
	Reverse flow indicated by negative sign			
Zero point adjustment	Manual via keypad or remote via digital input			
Ambient temperature	Operation: -4 to 122°F (–20 to +50°C)			
	During storage: -40 to 158°F (-40 to +70°C) (Humidity max. 95%)			
Communication	Prepared for client mounted add-on modules certified for Ex-use			
HART	***Active mode***		***Passive mode***	
(Terminals: 91-92)	U_o	6.51 V	Not available	
	Io	311 mA		
	Po	0.55 W		
	C_o	20 nF		
	L_o	100 µH		
PROFIBUS PA	***Active mode***		***Passive mode***	
(Terminals: 95-96)	Not available		U_i	17.5 V
			I_i	380 mA
			P_i	5.32 W
			C_i	5 nF
			L_i	10 µH

2.2.4 Transmitter Ex-d *(continued)*

Enclosure					
Material	Stainless steel AISI 316 W1.4435				
Rating	Compact mounted on sensor, IP 67 to IEC 529 and DIN 40050				
	Remote mounted, IP 65 to IEC 529 and DIN 40050				
Load	18 - 1000 Hz random, 1.14 G rms, in all directions, to IEC 68-2-36, Curve E				
EMC performance	Emission EN 50081-1 (Light industry)				
	Immunity EN 50082-2 (Industry)				
Namur	Within the value limits according to "Allgemeine Anforderung" with error criteria A in accordance with NE 21				
Supply voltage	***24 V a.c.***			***24 V d.c.***	
Range	20 to 30 V a.c.			18 to 30 V d.c.	
Power consumption	6 VA I_N = 250 mA, I_{ST} = 2A (30 msec.)			6 VA I_N = 250 mA, I_{ST} = 2A (30 msec.)	
Power supply	The power supply shall be from a safety isolating transformer. Maximal cable core is 2.5□			The power supply shall be from a safety isolating transformer. Maximal cable core is 2.5□	
Ex approval	EEx de [ia/ib] IIC T3-T6, DEMKO Ex 99E.124212X				
	Temperature class	T6	T5	T4	T3
	Process liquid temperature	T < 85°C T<185°F	85°C < T < 100°C 185°F < T < 275°F	100°C < T < 135°C 212°F < T < 275°F	135°C < T < 180°C 275°C < T <356°F

2.3 Meter uncertainty Display/frequency and pulse output



CMF - A	1.0	40	65 kg/h
CMF - B	12	125	250 kg/h
CMF - C	50	500	1000 kg/h
CMF - D	280	2800	5600 kg/h
CMF - E	1250	12500	25000 kg/h
CMF - F	2600	26000	52000 kg/h

- For flow > 5% of the sensors max. flow rate, the error can be read direct from the curve.
- For flow < 5% of the sensors max. flow rate, use the formula to calculate the error.
- The error curve is plotted from the formula:

$$E = \pm \sqrt{(0{,}10)^2 + \left(\frac{z \times 100}{qm}\right)^2}$$

E = Error [%]
Z = Zero point error [kg/h]
qm = Mass flow [kg/h]

Measuring pipe type	**TRANSMITTER**					
Measuring pipe version	CMF - A	CMF - B	CMF - C	CMF - D	CMF - E	CMF - F
Number of measuring pipes	1	1	1	1	1	1
Mass flow:						
• Linearity error % of rate	0.10	0.10	0.10	0.10	0.10	0.10
• Repeatability error % of rate	0.05	0.05	0.05	0.05	0.05	0.05
• Max. zero point error [kg/h]	0.002	0.03	0.15	0.66	3.0	6.0
Density:						
• Density error [g/cm³]	0.001	0.0015	0.0015	0.0005	0.0005	0.0005
• Repeatability error [g/cm³]	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001
Temperature:						
• Error [°C]	0.5	0.5	0.5	0.5	0.5	0.5
Brix:						
• Error [°Brix]	0.6	1.2	0.4	0.2	0.2	0.2

Reference conditions (ISO 9104 and DIN/EN 29104)

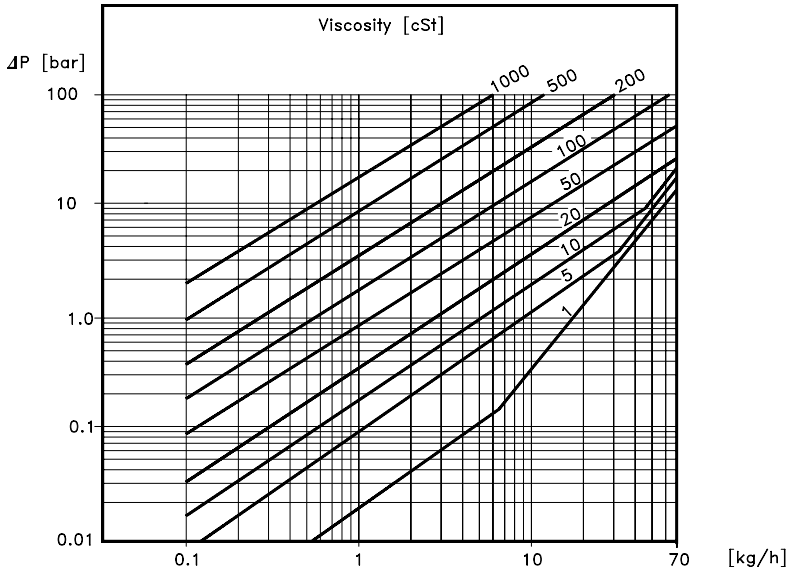
Flow conditions	Fully developed flow profile
Temperature of medium	-4°F (20°C) ± 2K
Ambient temperature	-4°F (20°C) ± 2K
Liquid pressure	2 ± 1 bar
Density	0.997 g/cm³
Brix	40 °Brix
Supply voltage	Un ±1%
Warming-up time	30 min.
Cable length	16.4 F (5 m) between converter and sensor

Additions in the event of deviations from reference conditions

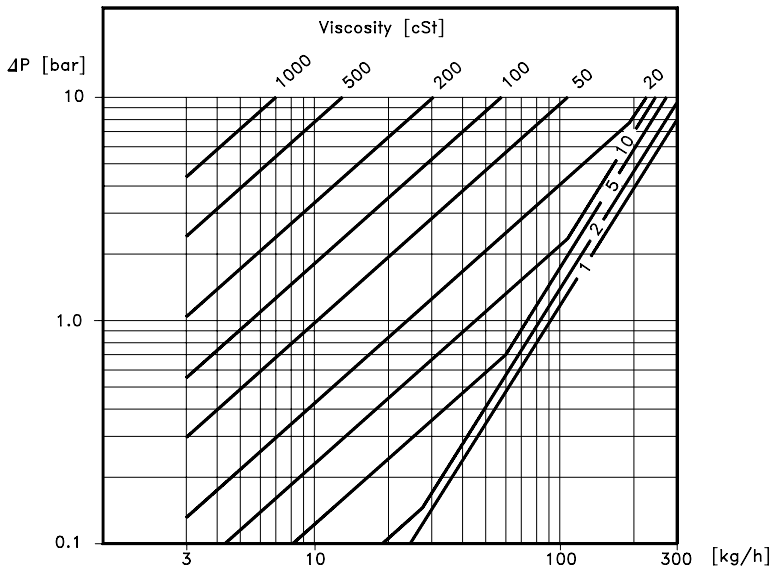
Current output	As pulse output ±(0.1% of actual flow +0.05% FSO)
Effect of ambient temperature	Display/frequency/pulse output: < ±0.003% / K act.
	Current output: < ±0.005% / K act.
Effect of supply voltage	< 0.005% of measuring value on 1% alteration

2.4 Pressure drop

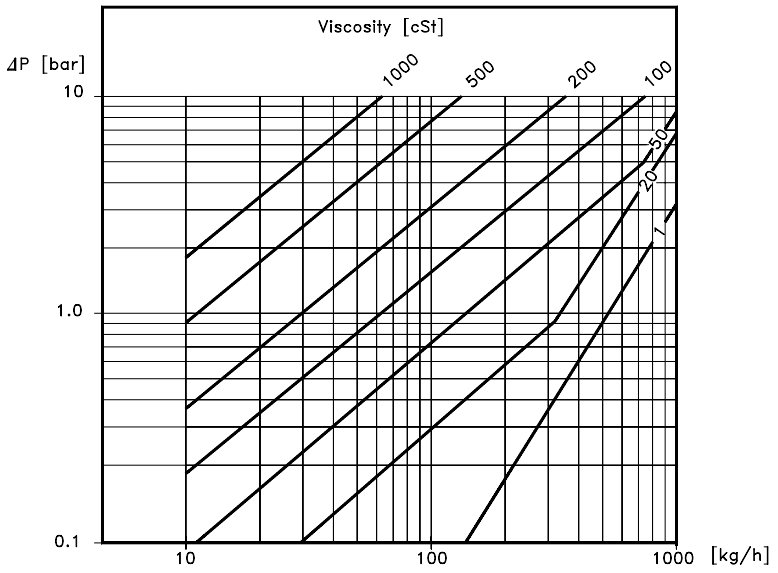
CMF - A



CMF - B

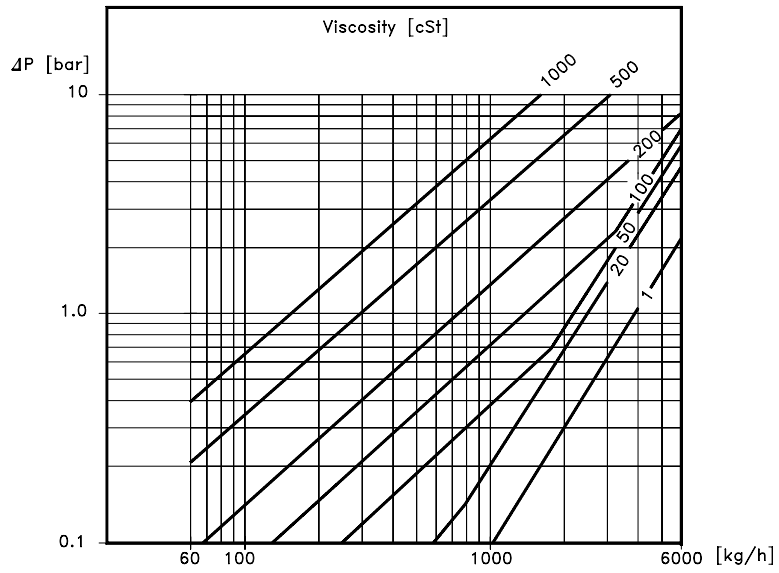


CMF - C

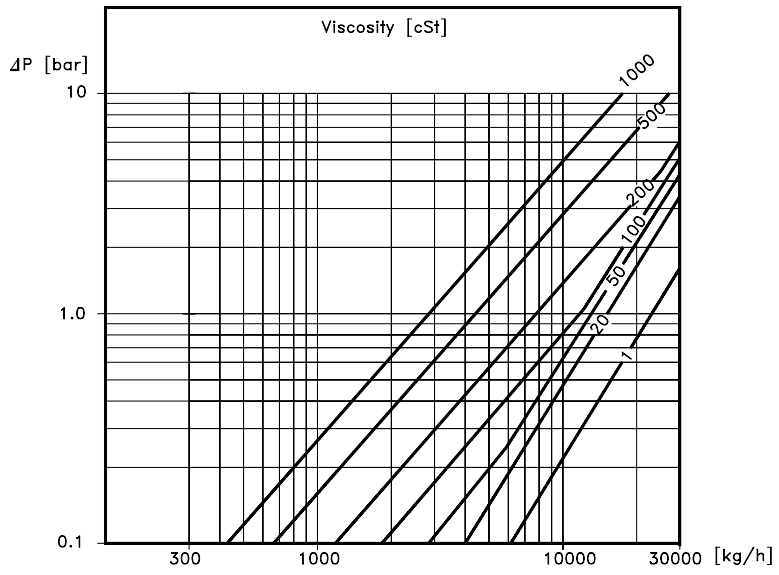


2.4 Pressure drop *(cont.)*

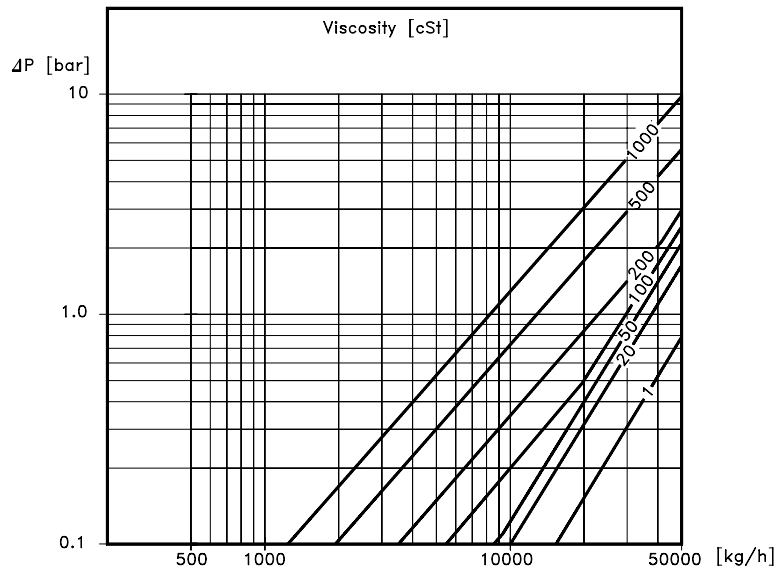
CMF - D



CMF - E



CMF - F



2.5 Sensor cable specification

Basic data	5 x 2 x 0.34 mm^2 twisted and screened in pairs
Diameter	Ø12 mm
Color	Blue
Length	Max. length between converter and sensor is 500 m
Capacitance	Max. 41 pf/m. Only requested for Ex-applications

2.6 HART® Communication Add-on module

Application	All TRANSMITTERS
Communication standard	Bell 202 frequency shift keying (f.s.k.) standard
Communication modes	• Single loop mode
	• Multi-drop mode, 14 slave devices
Communicator	Rosemount Hand held communicator type 275

Cable specification

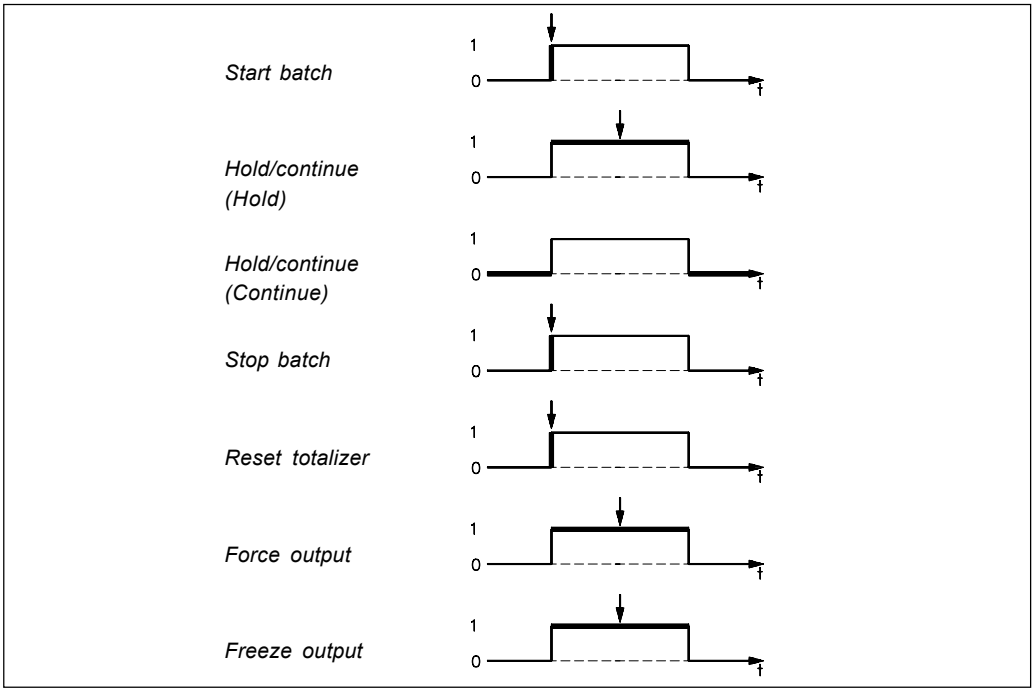
Basic data		
Q [mm^2] CU		≥ 0.2 mm^2/AWG 24
Screen		YES (Overall screen)
Loop resistance	*Min.*	230 Ω
	Max.	800 Ω
Cable capacity		≤ 400 μF/m
Cable length		1500 m
Twisted pair		YES

HART® is a registered trademark of the HART Communication Foundation.

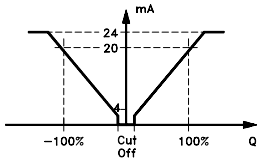
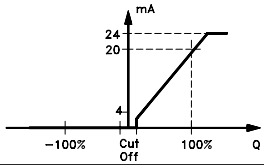
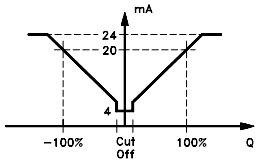
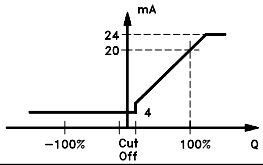
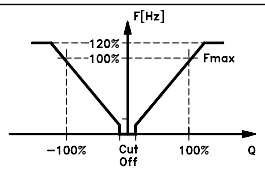
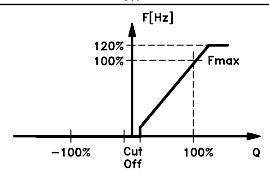
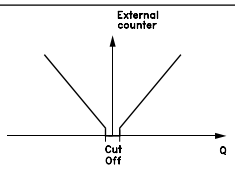
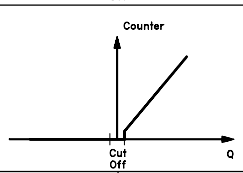
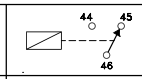
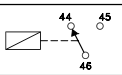
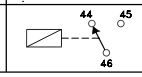
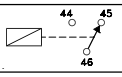
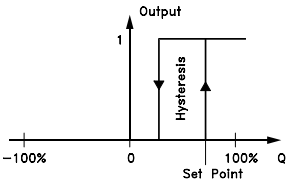
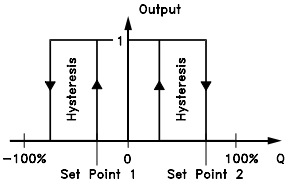
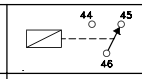
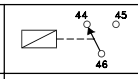
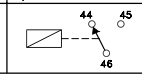
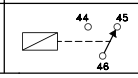
2.7 PROFIBUS® Communication Add-on module

General specification	
Profibus device profile	Class B, V2.0
Flow transducer block parameter sets supported	Class 03 Coriolis
Applicable standard	EN 50170, DIN 19245
Physical layer (transmission technology)	IEC 1158-2
Transmission speed	31.25 kbit/sec.
Number of stations	Up to 32 per line segment. Maximum total of 126
Cable	Two wire twisted pair
Bus termination	Passive line terminaton at both ends

2.8 Input characteristics



2.9 Output characteristics

Output characteristics	Bidirectional mode	Unidirectional mode
0-20 mA		
4-20 mA		
Frequency		
Pulse output		
Relay	Power supply off 	Power supply on 
Error relay	No error 	Error 
Limit switch or direction switch *Limit parameters: Flow, density, temperature, fraction*	1 set point	2 set points
		
Example with flow selected as parameter	Low flow (Reverse flow) 	Intermediate flow 
	High flow (Forward flow) 	High flow/ Low flow 
Batch on digital output