

Thermal Mass Flowmeter Sensyflow FMT400-VTS, FMT400-VTCS

for gases, integral mount design

- **Direct measurement of gas mass flow**
 - No additional pressure and temperature compensation required
- **Wide measuring range up to 1:100**
 - Factory-calibrated, with (optional) DKD calibration certificate
 - Process-calibrated with clean gases and gas mixtures (optional)
- **High measuring accuracy**
- **Short response time of less than 0.5 seconds**
 - Optimized for sophisticated process control applications
- **Negligible pressure loss**
- **No moving parts, no wear, maintenance-free**
- **Defined, reproducible mounting position in the middle of the conduit**
 - Pipe components for DN 25 ... DN 200 (1 ... 8")
 - Weld-on adapters for larger diameters and square ducts
 - Reliable and convenient hot tap fittings
- **Application-oriented models:**
- **FMT400-VTS
for process engineering**
 - Robust and variable
- **FMT400-VTCS
for the food and beverage industry**
 - Hygienic version, suitable for CIP and SIP



**Direct mass flow measurement
High accuracy
Integral mount design**

Contents

1	General information	3
1.1	Principle of operation and construction	3
1.2	Type overview	4
1.3	Overview Sensyflow FMT400-VTS, version for process engineering	4
1.4	Overview Sensyflow FMT400-VTCS, hygienic version	5
2	Specifications	6
2.1	Parameterization	7
3	Sensyflow FMT400-VTS, version for process engineering	8
3.1	Dimensions	8
3.2	Installation instructions	9
3.3	Ordering information	13
3.4	Additional ordering information for calibration	15
4	Sensyflow FMT400-VTCS, hygienic version	16
4.1	Dimensions	16
4.2	Measuring ranges at atmospheric pressure	17
4.3	Ordering information	18
4.4	Additional ordering information for calibration	19
5	Electrical connections	20
6	Recommended steadying lengths according to DIN EN ISO 5167-1	21
7	Questionnaire	22

1 General information

1.1 Principle of operation and construction

The devices of the Sensyflow FMT400-series operate according to the thermal measuring principle of a hot film anemometer. This measuring method determines the gas mass flow directly. Taking the standard density of the gases into consideration, the standard volume flow rate can be displayed without additional pressure and temperature compensation.

Sensyflow FMT400-VTS is used in the field of process engineering and Sensyflow FMT400-VTCS in the food and beverage industry for flow measurement of gases and gas mixtures.

The measuring systems of the FMT400 series are made up of a transmitter, flowmeter sensor and a pipe component. The transmitter directly delivers an electrically isolated 0/4 ... 20 mA output signal. The flowmeter sensor is designed as flange-mounted and is installed in the pipe component in a defined way.

The pipe component is available in nominal diameters ranging from DN 25 ... DN 200 (1 ... 8") and in various designs. It is also possible to install the flowmeter sensor in square ducts or pipes of any diameter by using a weld-on adapter.

Physics of measurement

Thermal flow metering procedures use different ways to evaluate the flow dependent cooling of a heated resistor as measuring signal.

In a hotfilm anemometer with temperature difference control, the heated platinum resistor is maintained at a constant overtemperature in relation to an unheated platinum sensor inside the gas flow. The heating power required for maintaining the overtemperature depends directly on the flow rate and the material properties of the gas. With a known (and constant) gas composition the mass-flow can be determined by electronically evaluating the heater current/mass-flow curve without additional pressure and temperature compensation.

Together with the standard density of the gas this results directly in the standard volume flow. Considering the high measuring range dynamics up to 1:150, an accuracy smaller than 1 % of the measuring value is achieved.

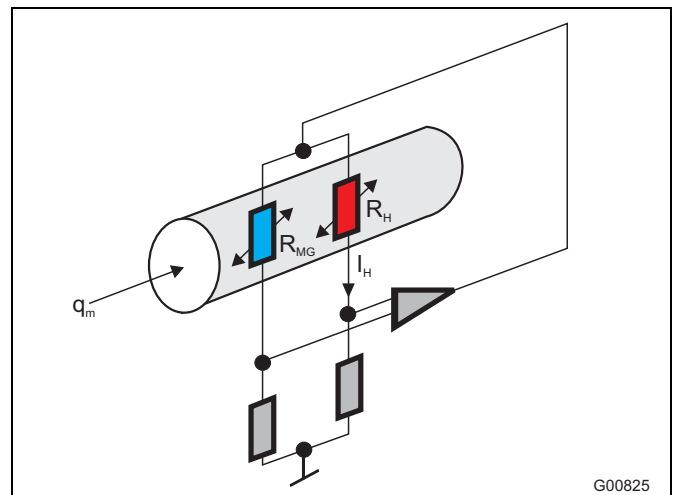


Fig. 1: Analog measuring principle

q_m	Gas mass-flow
R_{MG}	Gas temperature measuring resistor
R_H	Heating resistor
I_H	Actual value of heater

The gas stream flows past two temperature-sensitive resistors R_H and R_{MG} which are part of an electrical bridge circuit. Due to the chosen resistance ratio $R_H < R_{MG}$, R_H is heated by the current I_H , and R_{MG} adopts the same temperature as the gas. The current I_H is preset by the electronic control circuit to produce a constant temperature difference between the heated resistor R_H and the temperature of the gas.

The electrical power generated with resistor R_H exactly compensates its loss of heat to the gas flow. As this loss of heat is dependent on the number of particles which collide with the surface of resistor R_H , I_H represents a measure of the mass flow rate.

Typical applications

- Gas flow measurement in the chemical and processing industries,
- Compressed air balances,
- Gas burner control,
- Gas measurement for air separation systems,
- Activation air measurement in sewage plants,
- Hydrogen measurement in processes.

1.2 Type overview

Type	FMT400-VTS	FMT400-VTCS Hygienic version
Application	Process engineering	Food and beverage industry
Measured gases	Flow rate of gases and gas mixtures with known composition	Flow rate of air, N ₂ , CO ₂ , O ₂
Explosion protection	Manufacturer's Declaration zone 2 / 22 II 3G EEx nA ib II T4; II 3D T 135°C IP 65	
Design / Dimensions / Weight	dependent on nominal size	
Material (standard)	1.4571, Ceramics	Stainless steel e. g. 1.4301
Process connection (standard)	Flange acc. to EN1092-1 form B1, PN 40 (DIN 2635 form C) or ASME B 16.5 Cl. 150 / 300	Pipe fitting S acc. to DIN 11851 or FG flange
System components	Transmitter Flowmeter sensor Pipe component, design 1 or 2 or weld-on adapter	Transmitter Flowmeter sensor Pipe component
Standard nominal pipe sizes	Pipe component design 1: wafer flange DN 40, 50, 65, 80, 100, 125, 150, 200 – ASME 1 1/2", 2", 3", 4", 6", 8" Pipe component design 2: partial measuring section DN 25, 40, 50, 65, 80 – ASME 1", 1 1/2", 2" Weld-on adapter for square ducts or pipe diameters ≥ DN 100 (4")	Pipe component hygienic version: partial measuring section DN 25, 40, 50, 80
Degree of protection	IP 65 / NEMA 4X	

1.3 Overview Sensyflow FMT400-VTS, version for process engineering

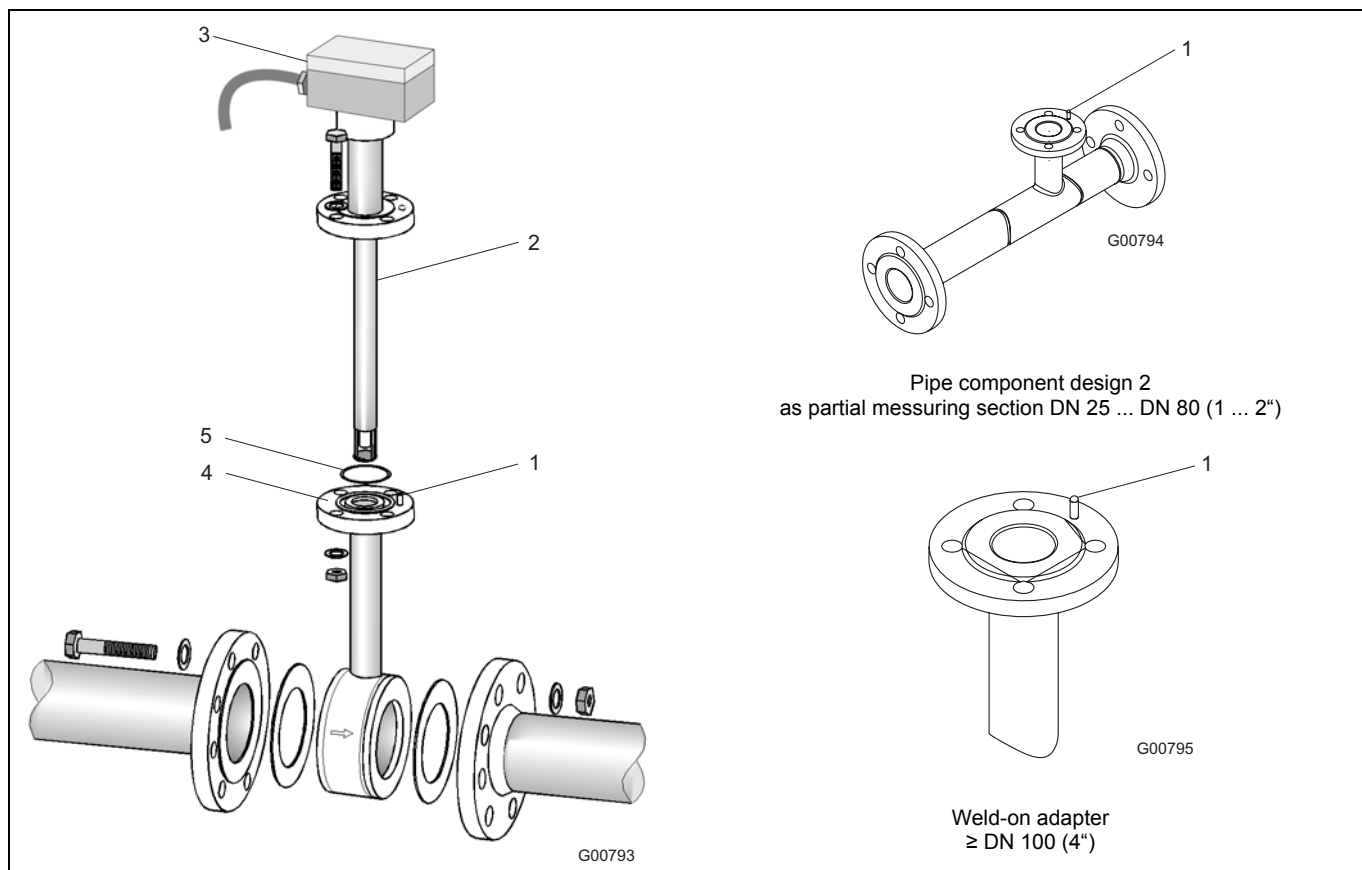


Fig. 2

- 1 Centering pin on outlet side
- 2 Flowmeter sensor FMT400-VTS
- 3 Transmitter
- 4 Pipe component design 1 in wafer flange design DN 40 ... DN 200 (1 1/2 ... 8")
- 5 Sealing ring

1.4 Overview Sensyflow FMT400-VTCS, hygienic version

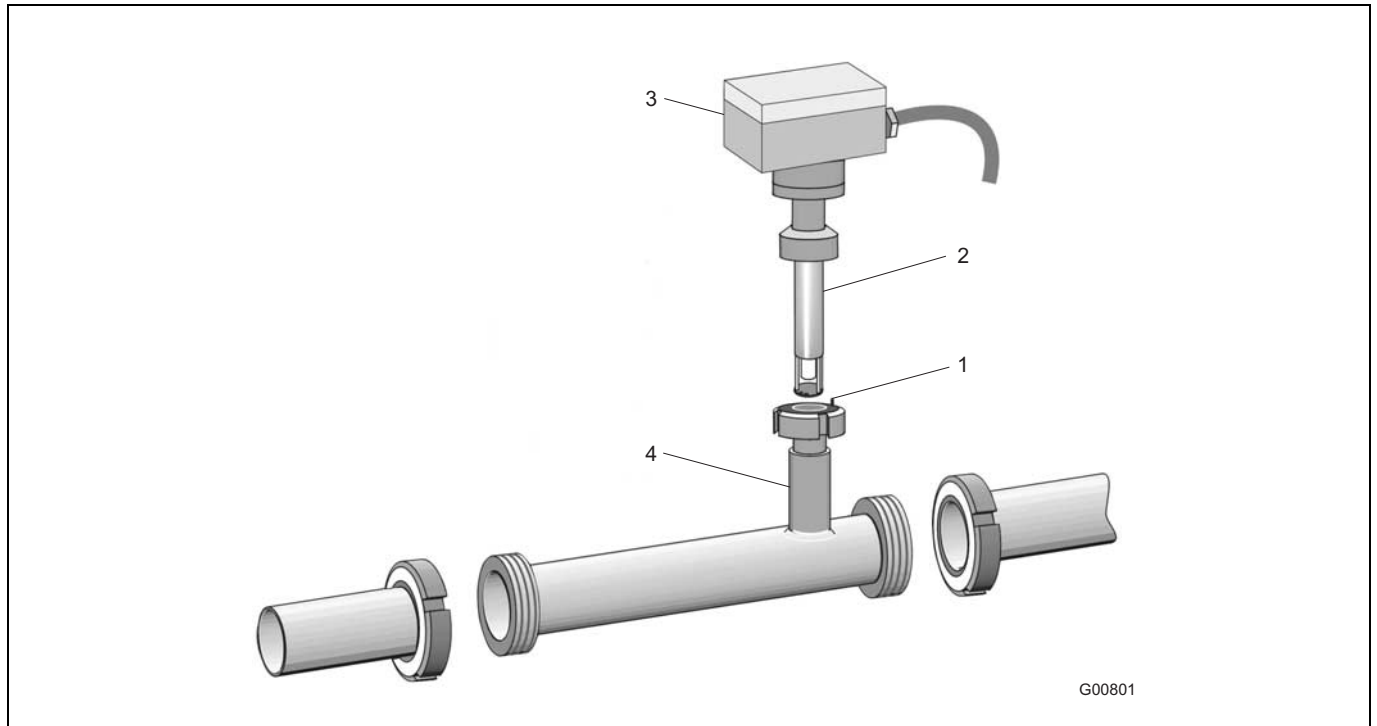


Fig. 3: Process connections with pipe fitting S acc. to DIN 11851. Flowmeter sensor and pipe component also available with FG flanges. FG flanges on the pipe component are always plain on both sides (without groove).

- 1 Centering pin on outlet side
- 2 Flowmeter sensor FMT400-VTCS
- 3 Transmitter
- 4 Pipe component

2 Specifications

Type	FMT400-VTS				FMT400-VTCS Hygienic version			
Measured variable (measured gases)	Flow rate of gases and gas mixtures with known composition				Flow rate of air, N ₂ , CO ₂ , O ₂			
Measuring ranges Nominal diameters (DN)	q_{min} kg/h	q_{max} kg/h	q_{min} Nm ³ /h	q_{max} Nm ³ /h	q_{min} kg/h	q_{max} kg/h	q_{min} Nm ³ /h	q_{max} Nm ³ /h
	for 0 °C (32 °F) / 1013.25 hPa (14.696 psia)				for 0 °C (32 °F) / 1013.25 hPa (14.696 psia)			
DN 25	0 ...	160	0 ...	120	0 ...	160	0 ...	120
DN 40	0 ...	430	0 ...	330	0 ...	430	0 ...	330
DN 50	0 ...	700	0 ...	540	0 ...	700	0 ...	540
DN 65	0 ...	1,200	0 ...	940				
DN 80	0 ...	1,700	0 ...	1,300	0 ...	1,700	0 ...	1,300
DN 100	0 ...	3,000	0 ...	2,300				
DN 125	0 ...	5,100	0 ...	3,900				
DN 150	0 ...	8,000	0 ...	6,200				
DN 200	0 ...	13,000	0 ...	10,000				
up to 3000 mm	0 ...	2,700,000	0 ...	2,100,000				
(Square ducts and larger diameters on request)								
Measuring ranges Nominal diameters (inch)	q_{min} lbs/h	q_{max} lbs/h	q_{min} SCFM	q_{max} SCFM				
	for 0 °C (32 °F) / 1013.25 hPa (14.696 psia)							
1.0	0 ...	310	0 ...	65				
1.5	0 ...	840	0 ...	180				
2.0	0 ...	1,400	0 ...	310				
3.0	0 ...	3,500	0 ...	760				
4.0	0 ...	6,000	0 ...	1,300				
6.0	0 ...	16,500	0 ...	3,600				
8.0	0 ...	28,500	0 ...	6,200				
120.0	0 ...	6,000,000	0 ...	1,300,000				
(Square ducts and larger diameters on request)								
Note regarding measuring ranges	The above values are reference values for applications involving air or nitrogen under atmospheric conditions (other gases available upon request). The values for q _{max} can be increased by approx. 10 % upon request (with lower accuracy in the extended range).							
Measured error Air, nitrogen, other gases	Under calibration conditions in the stated measuring range ≤ ± 0.9 % of measured value ± 0.05 % of possible end value in this nominal diameter (see measuring ranges) ≤ ± 1.8 % of measured value ± 0.10 % of possible end value in this nominal diameter (see measuring ranges) Special calibration on request							
Repeatability	< 0.25 % of measured value, t _{meas} = 10 s							
Influence of measuring medium temperature	< 0.05 % / K of measured value (dependent on type of gas)							
Influence of measuring medium pressure	< 0.2 %/100 kPa (/bar) of measured value (dependent on type of gas)							
Response time	T ₆₃ = 0.5 s				T ₆₃ = 2 s			

Type	FMT400-VTS	FMT400-VTCS Hygienic version
Operating conditions		
Recommended inlet and outlet runs	According to DIN EN ISO 5167-1 min. inlet 15 x D, outlet 5 x D	
Environmental conditions		
Ambient temperature transmitter	-25 ... 70 °C (-13 ... 158 °F) Zone 2/22 version: -20 ... 50 °C (-4 ... 122 °F)	
Storage temperature	-25 ... 85 °C (-13 ... 185 °F)	
Process conditions		
Operating temperature measuring medium (flowmeter sensor)	Standard range: -25 ... 150 °C (-13 ... 302 °F) Extended range: -25 ... 300 °C (-13 ... 572 °F) Zone 2/22 version: -20 ... 130 °C (-4 ... 266 °F)	-25 ... 150 °C (-13 ... 302 °F)
Operating pressure (max.)	4 x 10 ⁶ Pa (40 bar [580 psi])	16 x 10 ⁵ Pa (16 bar [232 psi]) pipe fitting S (for DN 80: 10 x 10 ⁵ Pa (10 bar [145 psi])) 10 x 10 ⁵ Pa (10 bar [145 psi]) FG flange
Pressure loss (logarithmic diagram)	<p>< 1.0 kPa (10 mbar), typical value 0.1 kPa (1 mbar)</p> <p style="text-align: right;">G00796</p>	
Power supply		
Voltage	24 V DC ± 25 %; 24 V AC ± 25 %, 48 ... 62 Hz	
Power consumption	< 15 W, power consumption < 600 mA, slow-blow fuse of at least 2 A recommended	
Cable entry	M20 x 1.5	
Output		
Analog output	0/4 ... 20 mA, Bürde < 750 W, electrical isolated, alert < 3.5 or > 22 mA	
Type of protection	IP 65 / NEMA 4X	

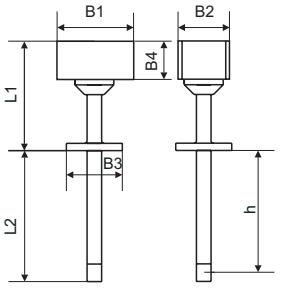
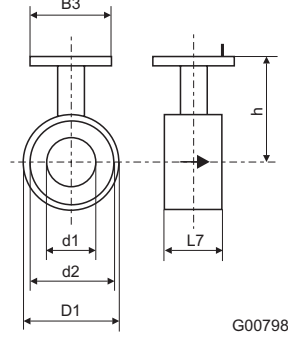
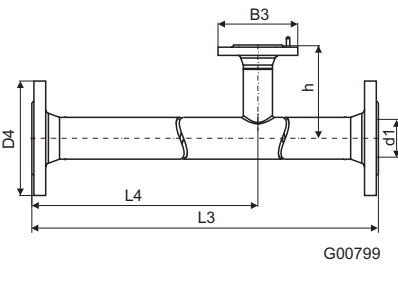
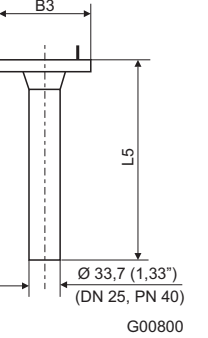
2.1 Parameterization

The output signal range of the FMT400-VTS / VTCS flowmeters can be set to either 0 ... 20 mA or 4 ... 20 mA. Additionally, the measuring range window can be extended such that a smaller span corresponds to a 20 mA current signal. Alarm signalling is possible at < 3.5 mA or > 22 mA (selectable).

The measuring instrument parameters can be set via the LCI-adaptor. A standard PC allows you to change the used output signal and to adjust the measuring range.

3 Sensyflow FMT400-VTS, version for process engineering

3.1 Dimensions

Flowmeter sensor	Pipe component design 1 Wafer flange	Pipe component design 2 Partial measuring section	Weld-on adapter up to DN 100 (4")
 <p>G00797</p>	 <p>G00798</p>	 <p>G00799 optional with integrated flow straightener</p>	 <p>G00800</p>

EN 1092-1 form B1, PN 40									
Nominal diameter		L2	h	D1	d1	d2	D4	L3	L4
DN 25		269 (10.59)	263 (10.35)	-	28.5 (1.12)	-	115 (4.53)	600 (23.62)	486 (19.13)
DN 40	B1 = 125 (4.92)			94 (3.70)	43.1 (1.70)	88 (3.46)	150 (5.91)	860 (33.86)	731 (28.78)
DN 50	B2 = 80 (3.15)			109 (4.29)	54.5 (2.15)	102 (4.02)	165 (6.50)	1000 (39.37)	837 (32.95)
DN 65	B3 = Ø115 (4.53)			129 (5.08)	70.3 (2.77)	122 (4.80)	185 (7.28)	1400 (55.12)	1190 (46.85)
DN 80	B4 = 58 (2.28)			144 (5.67)	82.5 (3.25)	138 (5.43)	200 (7.87)	1700 (66.93)	1450 (57.09)
DN 100				170 (6.69)	107.1 (4.22)	162 (6.38)	-	-	-
DN 125	L1 = 188 (7.40)			196 (7.72)	131.7 (5.19)	188 (7.40)	-	-	-
DN 150	L5 = 450 (17.72)			226 (8.90)	159.3 (6.27)	218 (8.58)	-	-	-
DN 200	L7 = 65 (2.56)			293 (11.54)	206.5 (8.13)	285 (11.22)	-	-	-
> 350		431 (16.97)	425 (16.73)						
> 700		781 (30.75)	775 (30.51)						
ASME B 16.5, Cl. 150 (ANSI), Sch 40 S									
1"		269 (10.59)	263 (10.35)	-	26.6 (1.05)	-	108 (4.25)	560 (22.05)	454 (17.87)
1 1/2"	B1 = 125 (4.92)			85 (3.35)	40.9 (1.61)	73 (2.87)	127 (5.00)	864 (34.02)	741 (29.17)
2"	B2 = 80 (3.15)			103 (4.06)	52.6 (2.07)	92 (3.62)	154 (6.06)	1003 (39.49)	846 (33.31)
3"	B3 = Ø115 (4.53)			35 (5.31)	78.0 (3.07)	127 (5.00)	-	-	-
4"	B4 = 58 (2.28)			173 (6.81)	102.4 (4.03)	157 (6.18)	-	-	-
6"	L1 = 188 (7.40)			221 (8.70)	154.2 (6.07)	216 (8.50)	-	-	-
8"	L5 = 450 (17.72)			278 (10.94)	202.7 (7.98)	270 (10.63)	-	-	-
> 14"	L7 = 65 (2.56)	431 (16.97)	425 (16.73)						
> 28"		781 (30.75)	775 (30.51)						
ASME B 16.5, Cl. 300 (ANSI), Sch 40 S									
1"		269 (10.59)	263 (10.35)	-	26.6 (1.05)	-	123.9 (4.88)	560 (22.05)	454 (17.87)
1 1/2"	B1 = 125 (4.92)			94 (3.70)	40.9 (1.61)	73 (2.87)	155.4 (6.12)	864 (34.02)	741 (29.17)
2"	B2 = 80 (3.15)			110 (4.33)	52.6 (2.07)	92 (3.62)	165.1 (6.50)	1003 (39.49)	846 (33.31)
3"	B3 = Ø115 (4.53)			148 (5.83)	78.0 (3.07)	127 (5.00)	-	-	-
4"	B4 = 58 (2.28)			180 (7.09)	102.4 (4.03)	157 (6.18)	-	-	-
6"	L1 = 188 (7.40)			249 (9.80)	154.2 (6.07)	216 (8.50)	-	-	-
8"	L5 = 450 (17.72)			307 (12.09)	202.7 (7.98)	270 (10.63)	-	-	-
> 14"	L7 = 65 (2.56)	431 (16.97)	425 (16.73)						
> 28"		781 (30.75)	775 (30.51)						

Dimensions in mm (inch)

3.2 Installation instructions

3.2.1 Weld-on adapter for Sensyflow FMT400-VTS

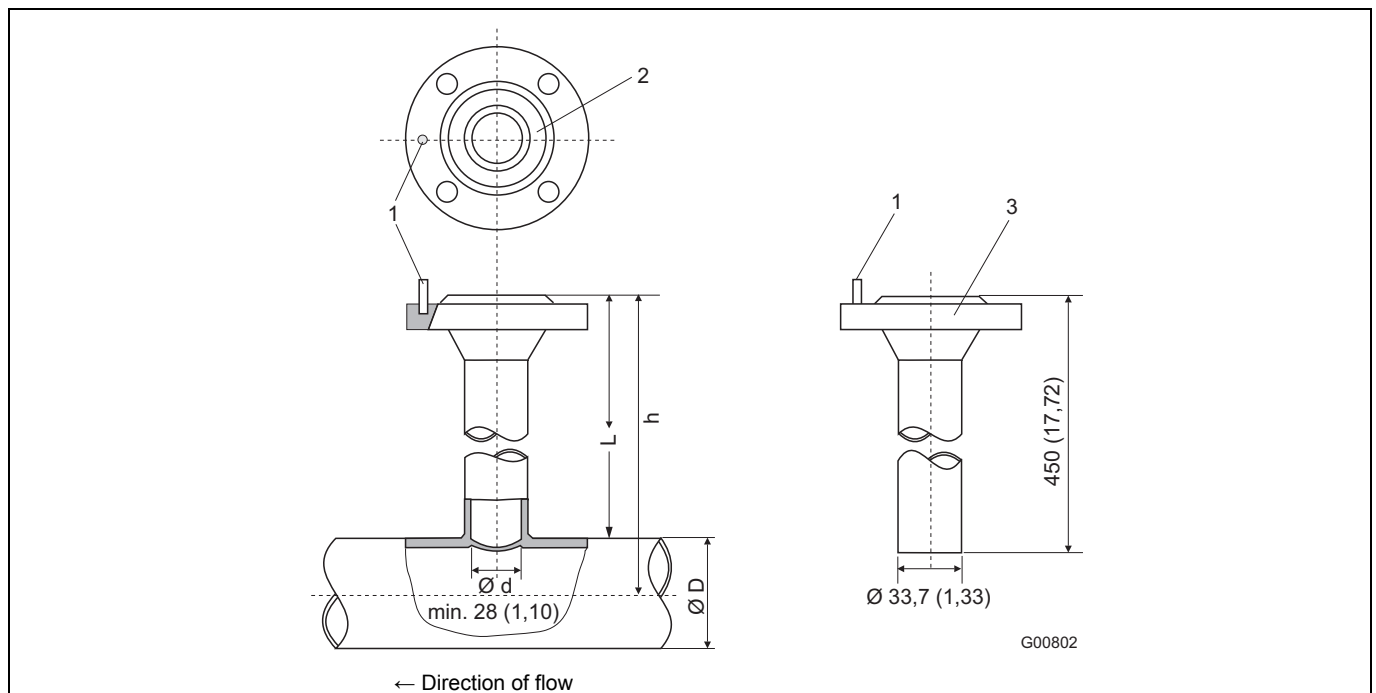


Fig. 4: Dimensions in mm (inch)

- 1 Centering pin
- 2 Sealing ring groove
- 3 Connection flange DN 25 (1")
- D Outer pipe diameter

Flowmeter sensor length h in mm (inch)	Outer pipe diameter min. / max. in mm (inch)
263 (10.35)	100 ... 350 (3.94 ... 13.78)
425 (16.73)	> 350 ... 700 (13.78 ... 27.56)
775 (30.51)	> 700 ... 1400 (27.56 ... 55.12) ¹⁾

¹⁾ This maximum pipe diameter specification is only valid when installing the sensor unit centrally in the pipe. For larger diameters or angular ducts a non-centric sensor position is taken into account for calibration.



Important

Prior to mounting the weld-on adapters must be shortened to length: $L = h - 1/2 D_{\text{outer}}$.

The distance h between the upper flange edge and the pipe center line must be within a tolerance of $\pm 2 \text{ mm}$ (0,08").

The right angle to the pipe center line must be observed (max. tolerance $\pm 2^\circ$).

The centering pin of the adapter must be aligned centrally with the pipe center line in flow direction (on outlet run side, downstream of the measuring point).

3.2.2 Weld-on adapter with ball valve for Sensyflow FMT400-VTS

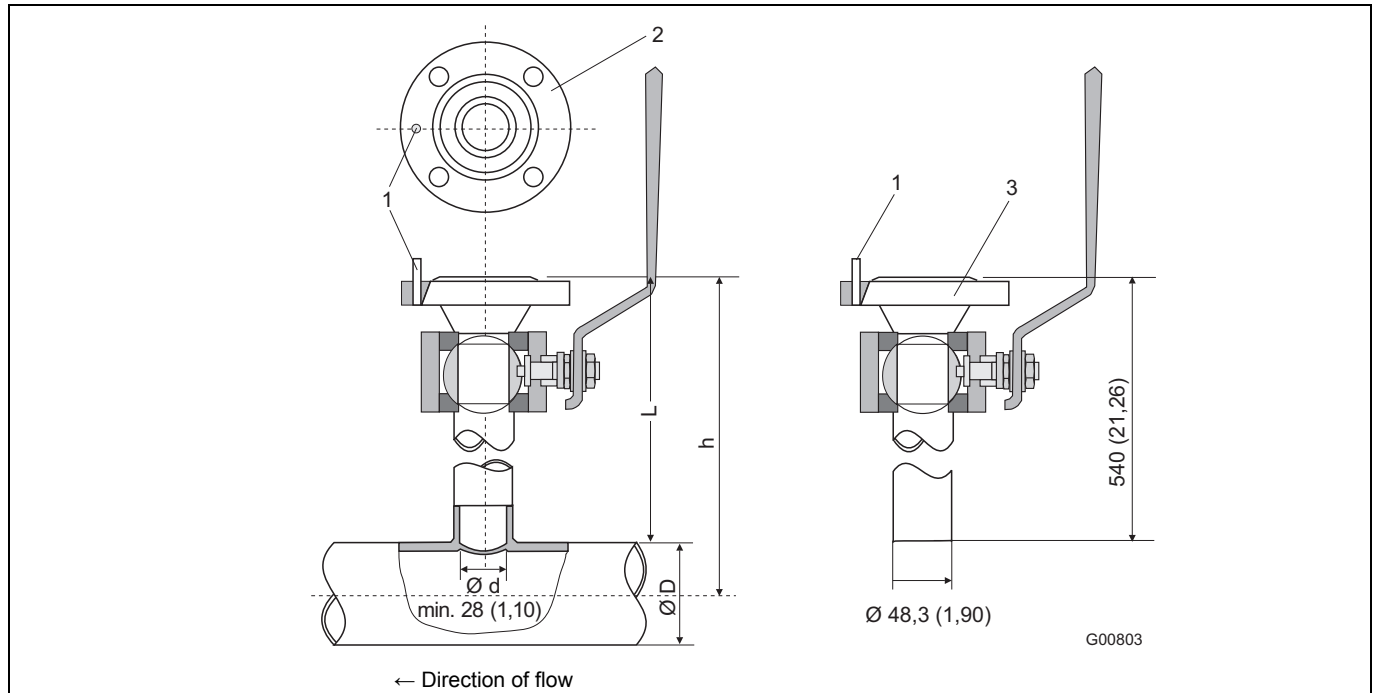


Fig. 5: Dimensions in mm (inch)

- 1 Centering pin
- 2 Sealing ring groove
- 3 Connection flange DN 25 (1")
- D Outer pipe diameter

Flowmeter sensor length h in mm (inch)	Outer pipe diameter min. / max. in mm (inch)
263 (10.35)	100 ... 150 (3.94 ... 5.91)
425 (16.73)	> 150 ... 500 (5.91 ... 19.69)
775 (30.51)	> 500 ... 1150 (19.69 ... 45.28) ¹⁾

¹⁾ This maximum pipe diameter specification is only valid when installing the sensor unit centrally in the pipe. For larger diameters or angular ducts a non-centric sensor position is taken into account for calibration.

i

Important

Prior to mounting the weld-on adapters must be shortened to length: $L = h - 1/2 D_{\text{outer}}$

The distance h between the upper flange edge and the pipe center line must be within a tolerance of $\pm 2 \text{ mm}$ (0,08").

The right angle to the pipe center line must be observed (max. tolerance $\pm 2^\circ$).

The centering pin of the adapter must be aligned centrally with the pipe center line in flow direction (on outlet run side, downstream of the measuring point).

3.2.3 Integrated hot tap fitting for Sensyflow FMT400-VTS

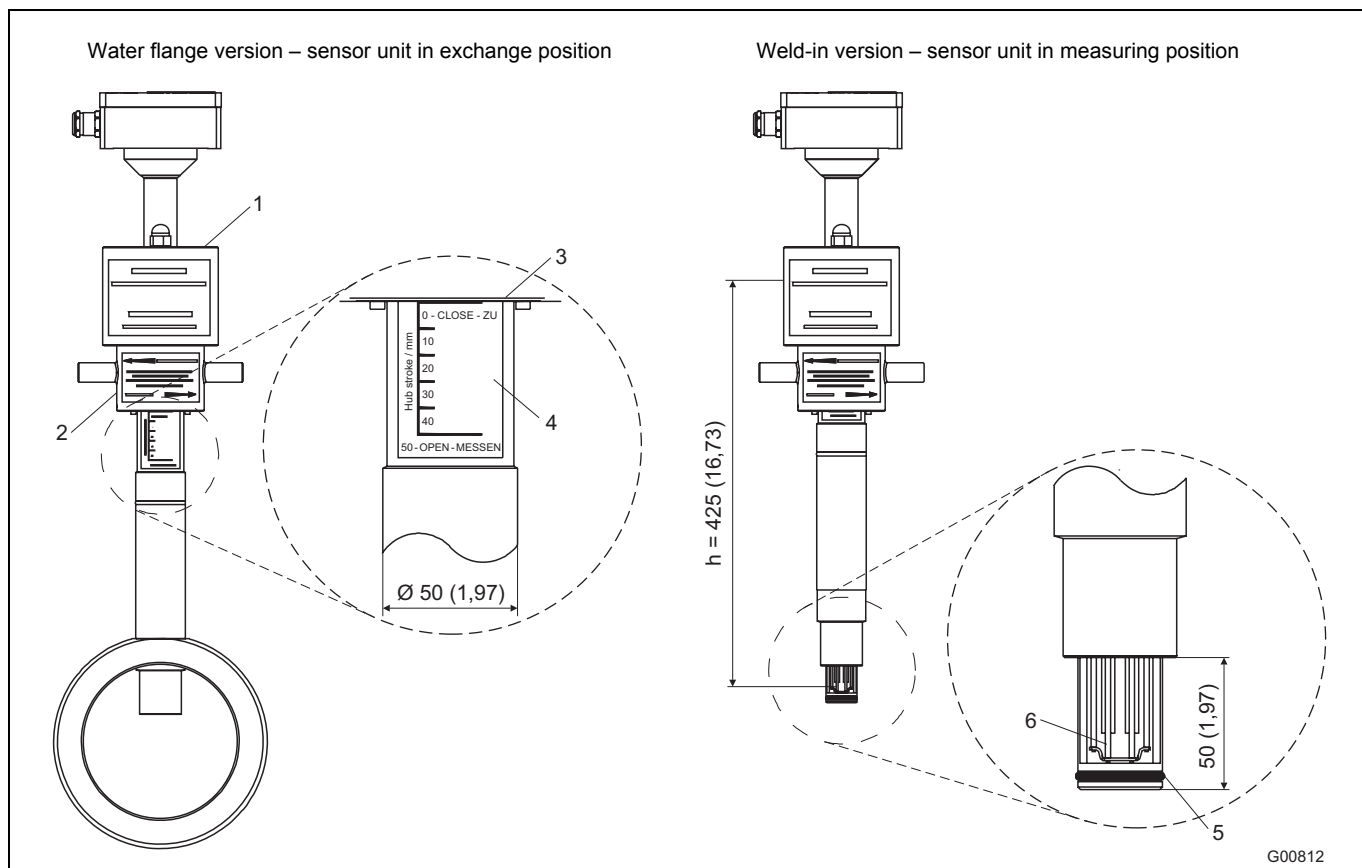


Fig. 6: Dimensions in mm (inch)

- 1 Covers for DN 25 flange
- 2 Spigot nut
- 3 Bottom edge of spigot nut
- 4 Display of sensor unit position, 50 mm (1,97") stroke
- 5 Sealing ring
- 6 Sensor elements

Flowmeter sensor length h	
Water flange version	Weld-in version
h = 263 mm (10.35") for DN 50, DN 65 and DN 80 / 2", 3" h = 425 mm (16.73") for DN 100, DN 125, DN 150 and DN 200 / 4", 6", 8"	h = always 425 mm (16.73")

The integrated hot tap fitting is used instead of the pipe component and weld-on adapter assembly described above if the flowmeter sensor must be exchangeable during operation with virtually no gas escaping from the system.

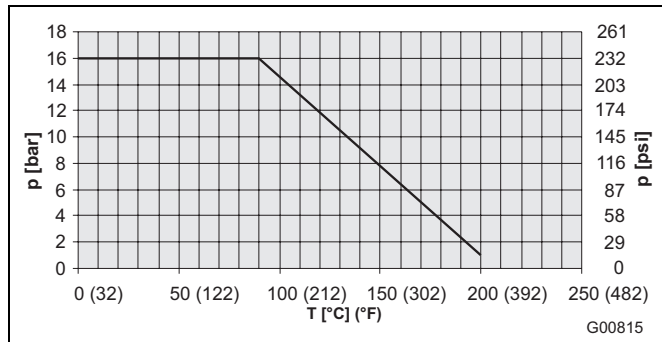


Fig. 7: Maximum pressure/temperature values for the integrated hot tap fitting

It is recommended to use the hot tap fitting for measurements in main conduits (e.g. compressed air systems) or for measuring points which otherwise require rinsing prior to removing the flowmeter sensor. As a rule, hot tap fittings should be preferred for all systems where, otherwise, the entire system or parts of it must be switched off to replace a flowmeter sensor.

Handling:

The flowmeter sensor is screwed to the hot tap fitting through the DN 25 flange. Then the cover is put on. The sensor unit is set from the exchange position to the measuring position by turning the spigot nut. The bottom edge of the spigot nut indicates the current sensor unit position (see Detail A, sensor unit is in exchange position). Only when the measuring position 50 – OPEN - MESSEN (lower stop of the spigot nut) is reached, the sensor elements are placed exactly in the center of the pipe and exact measurement is ensured.

i Important

For integrated hot tap fitting in wafer flange design DN 65, use connection flange PN16 with 4 screw holes on the process side. Wafer flange versions 2 ... 8" only for connection flange ASME B16.5 Cl.150.

3.3 Ordering information

	Main Code										Add. Code	
	Variant digit No.	1 - 6	7	8	9	10	11	12	13	14		15
Sensyflow FMT400-VTS Thermal Mass Flowmeter, for Process Engineering, for Gases, Integral mount Design	V14222	X	X	X	X	X	X	X	X	X	X	XXX
Sensor Unit Ceramic sensor		0										
Version VTS, process engineering				1								
VTS, process engineering, ATEX Zone 2 / 22				2								
Operating Temperature Standard range			4)	1								
Extended range -25 ... 300 °C (-15 ... 572 °F) (not with Ex-Version)				2								
Measuring Medium Gases, gas mixtures and natural gas (with max. 23.5 Vol% O2 each)					5)	0						
Oxygen / gas mixtures > 23.5 Vol% O2, oil and grease-free, with O2 certificate (max. 150 °C / 302 °F)						1						
Natural gas, with DVGW certificate (max. 80 °C / 176 °F)						2						
Hydrogen, Helium (max. 8 bar / 0.8 MPa / 116 psi, always with process gas calibration)					1)	3						
Mounting Length / Material 263 mm (10.4 in.) / AISI 316Ti SST (1.4571) (DN 25 ... DN 350 [1 ... 14 in.])						2)	1	0				
425 mm (17 in.) / AISI 316Ti SST (1.4571) (> DN 350 ... DN 700 [> 14 ... 28 in.])						2)	2	0				
775 mm (31 in.) / AISI 316Ti SST (1.4571) (> DN 700 [> 28 in.])						2)	3	0				
Analog Output 4 ... 20 mA, alarm < 3.5 mA								6)	1			
4 ... 20 mA, alarm > 22 mA								6)	2			
0 ... 20 mA								6)	3			
Number of Characteristic Curves 1 characteristic curve										1		
Certificates: Calibration Factory certificate											0	
DKD certificate of calibration with air (not for process gas calibration)									3)	1		
Certificates and Material Traceability Material certificate 3.1 acc. EN 10204												CBB
Declaration of compliance with the order 2.1 acc. EN 10204												CF3
Certificates: GOST GOST Russia - metrological approval												CG1
GOST Kazakhstan - metrological approval												CG2
Language of Documentation German												M1
English												M5

Accessories	Code
FMT Power supply unit, Housing for rail mounting 62.5 mm x 75 mm x 139 mm, Input 230 V AC, Output 24 V DC / 2.5 A	7962800
FMT200-D / FMT400 LCI Adapter, Local Communication Interface for parameterization, incl. Communication software	7962828

- 1) With measuring medium H2 or He in nominal size DN 25 ... DN 50 (1 ... 2 in.): Please use pipe component design 2 with flow straightener
- 2) Nominal size ranges when using pipe components or weld-on adapters without ball valve
- 3) PTB approved DKD calibration facility No. 05701
- 4) Non-Ex version: -25 ... 150 °C (-15 ... 302 °F), ATEX Zone 2 / 22 version: -20 ... 130 °C (-4 ... 266 °F)
- 5) Not for pure oxygen
- 6) Changeable via LCI Adapter

	Main Code						Add. Code	
	Variant digit No.	7	8	9	10	11		12
FMT081 Pipe component / weld-on adapter, for Sensyflow FMT500-IG and FMT400-VTS	FMT081	X	X	X	X	X	X	XXX
Measuring Medium								
Gases, gas mixtures and natural gas (each max. 23.5 Vol% O ₂)		A						
Oxygen/gas mixtures > 23.5 Vol% O ₂ , oil and grease-free, with O ₂ certificate (max. 150 °C/302 °F)		B						
Natural gas, with DVGW certificate (max. 80 °C / 176 °F)		C						
Hydrogen, Helium	8)	D						
Design								
Pipe component design 1 in wafer flange version			1					
Pipe component design 2 as partial measuring section			2					
Pipe component design 2 as partial measuring section with integrated flow straighteners			3					
Weld-on adapter	1)		4					
Others			9					
Nominal Diameter								
Selection for weld-on adapter				Y				
DN 25 (1 in.)			2)	A				
DN 40 (1-1/2 in.)			9)	C				
DN 50 (2 in.)				D				
DN 65 (2-1/2 in.)			10)	E				
DN 80 (3 in.)			11)	F				
DN 100 (4 in.)			3)	G				
DN 125 (5 in.)			4)	H				
DN 150 (6 in.)			3)	J				
DN 200 (8 in.)			3)	L				
Others			12)	Z				
Flange Style and Pressure Rating								
Selection for weld-on adapter					0			
DIN PN 40, nominal pressure 40 bar (4 MPa / 580 psi)					1			
ANSI / ASME 150 lb, Schedule 40 S					2			
ANSI / ASME 300 lb, Schedule 40 S				9)	3			
Others					9			
Process Connection for Flowmeter sensor								
Standard Sensyflow flange with centering pin				5)		A		
With ball valve, max. 150 °C (302 °F) and 16 bar (1.6 MPa / 232 psi)				6)		G		
With integrated hot tap fitting for max. DN 125 (5 in.). Allows gas-tight flowmeter sensor removal / insertion up to 16 bar (1.6 MPa / 232 psi) or 200 °C (392 °F). For DN 65, use connection flanges PN 16 (16 bar / 1.6 MPa / 232 psi) with 4 screw holes				7)		H		
With integrated hot tap fitting above DN 125 (5 in.) to max. DN 200 (8 in.). Allows gas-tight flowmeter sensor removal / insertion up to 16 bar (1.6 MPa / 232 psi) or 200 °C (392 °F)				13)		J		
Material								
Stainless steel AISI 316Ti (1.4571)							3	
Carbon steel S 235 (1.0037)						14)	1	
Blind Flange								
DN 25 blind flange to close flowmeter sensor connection, material stainless steel AISI 316Ti (1.4571)								F3
Certificates and Material Traceability								
Material certificate 3.1 acc. EN 10204								CBB
Declaration of compliance with the order 2.1 acc. EN 10204								CF3

Footnotes see next page

- 1) From DN 100 (4 in.)
- 2) Not available with pipe component 1 in wafer flange version
- 3) Not available with pipe component 2 as partial measuring section
- 4) Not available with pipe component 2 as partial measuring section. Not available with flange style ANSI / ASME
- 5) Correct sensor length: For pipe component 1 and 2 without ball valve / hot tap fitting: h = 263 mm. For weld-on adapter and pipe diameter up to 350 mm: h = 263 mm, up to 700 mm: h = 425 mm, > 700 mm: h = 775 mm
- 6) Not available with DVGW certificate. Correct sensor length: For pipe component DN 50 ... DN 100: h = 263 mm, from DN 125: h = 425 mm. For weld-on adapter up to 150 mm: h = 263 mm, up to 500 mm: h = 425 mm, > 500 mm: h = 775 mm
- 7) Not available with DVGW certificate. Correct sensor length: For pipe component DN 50 ... DN 80: h = 263 mm, for pipe component from DN 100 and weld-on adapter: h = 425 mm
- 8) Max. 8 bar / 0.8 MPa / 116 psi. With DN 25 ... DN 50 (1 ... 2 in.): Please use pipe component 2 with flow straightener
- 9) Not available with hot-tap-fitting
- 10) Not available with flange style ANSI / ASME
- 11) Not available with pipe component 2 in combination with flange style ANSI / ASME
- 12) Please specify exact inner pipe diameter
- 13) Not available with DVGW certificate. Please apply the correct sensor length
- 14) Only for weld-on adapter without ball-valve. Only without certificates

3.4 Additional ordering information for calibration

FMT400-VTS, FMT400-VTCS		
Gas component 1	Vol. %	(clear text)
Gas component 2	Vol. %	(clear text)
Gas component 3	Vol. %	(clear text)
Gas component 4	Vol. %	(clear text)
Gas component 5	Vol. %	(clear text)
Gas component 6	Vol. %	(clear text)
Gas component 7	Vol. %	(clear text)
Gas component 8	Vol. %	(clear text)
Gas component 9	Vol. %	(clear text)
Gas component 10	Vol. %	(clear text)
		Sum 100 %
Operating temperature		(clear text)
Operating pressure		(clear text)
Nominal diameter, Pipe inner diameter (mm)		(clear text)
Measuring range		(clear text)
Unit		(clear text)
Standard state (e.g. 0 °C, 1013 mbar)		(clear text)
Adjusted measuring range		(clear text)

4 Sensyflow FMT400-VTCS, hygienic version

4.1 Dimensions

Pipe fitting S according to DIN 11851

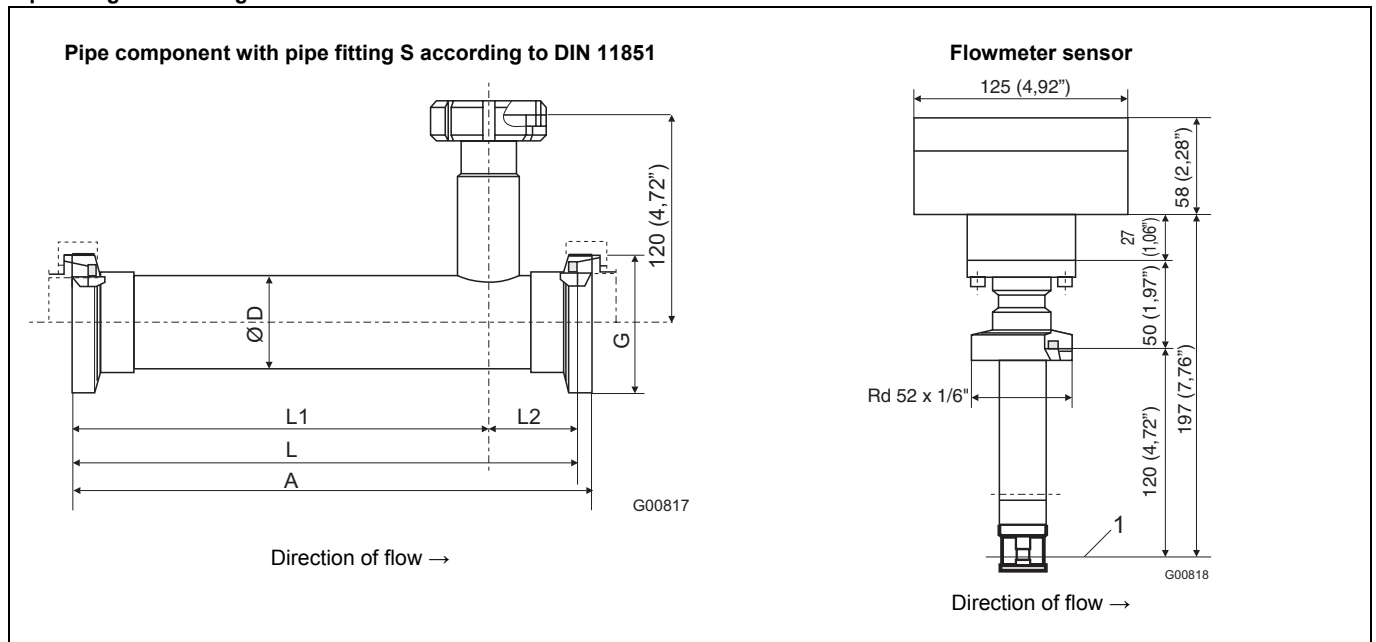


Fig. 8: Nominal pressure PN16 for DN 25, DN 40, DN50; PN10 for DN 80

1 Centre of pipe component

DN	A	L	L1	L2	Ø D	G
25 (1")	196 (7.72)	182 (7.17)	140 (5.51)	42 (1.65)	28 x 1 (1.10 x 0.04)	Rd52 x 1/6"
40 (1.5")	284 (11.18)	270 (10.63)	205 (8.07)	65 (2.56)	40 x 1 (1.57 x 0.04)	Rd62 x 1/6"
50 (2")	344 (13.54)	330 (12.99)	265 (10.43)	65 (2.56)	52 x 1 (2.04 x 0.04)	Rd78 x 1/6"
80 (3")	526 (20.71)	510 (20.08)	425 (16.73)	85 (3.35)	85 x 2 (3.35 x 0.08)	Rd110 x 1/4"

Dimensions in mm (inch)

FG flange

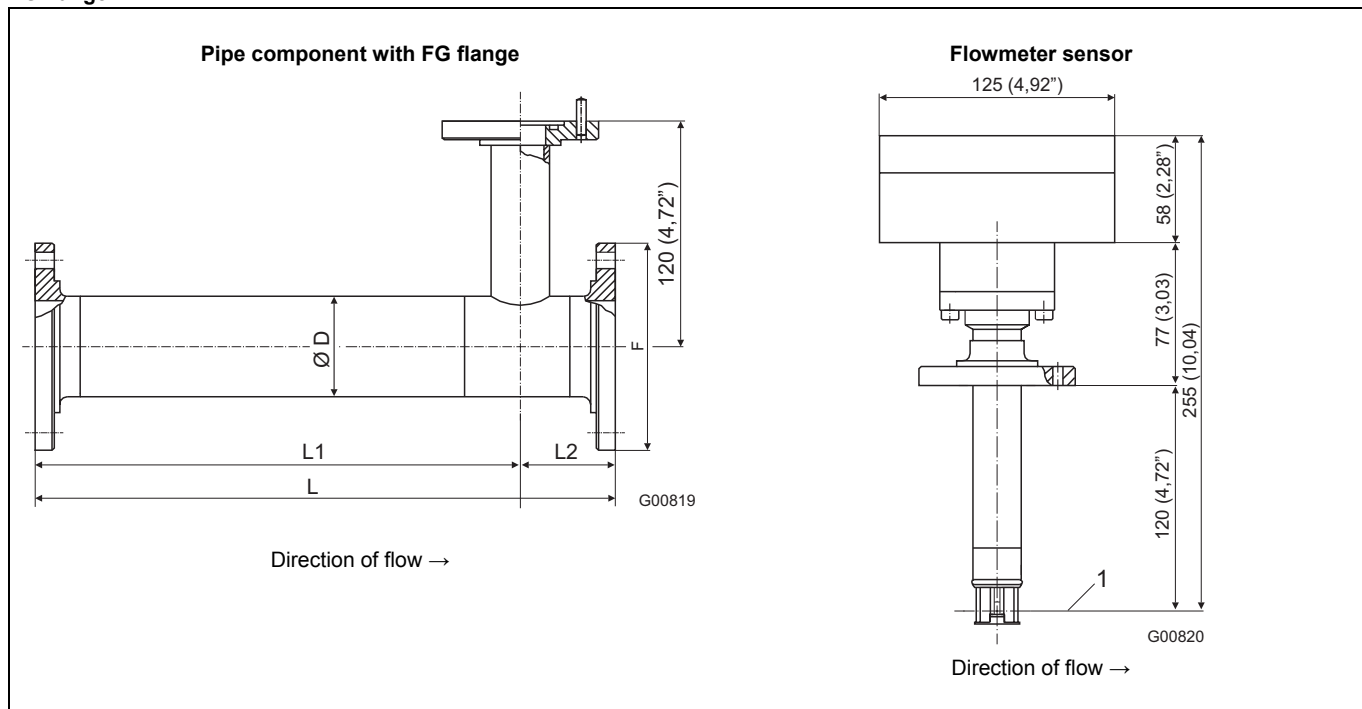


Fig. 9: FG1, PN10

1 Centre of pipe component

DN	L	L1	L2	Ø D	F
25 (1")	175 (6.89)	133 (5.24)	42 (1.65)	29 x 1.5 (1.14 x 0.06)	83 (3.27)
40 (1.5")	270 (10.63)	205 (8.07)	65 (2.56)	42 x 2 (1.65 x 0.08)	100 (3.94)
50 (2")	330 (12.99)	265 (10.43)	65 (2.56)	54 x 2 (2.12 x 0.08)	110 (4.33)

The FG flanges on the pipe component's process side are always smooth (without groove).

Dimensions in mm (inch)

4.2 Measuring ranges at atmospheric pressure

Type of gas		Air, nitrogen, oxygen -25 ... 150 °C (-13 ... 302 °F)											
Nominal diameter		q_{min} kg/h		q_{max} kg/h		q_{min} Nm ³ /h		q_{max} Nm ³ /h		q_{min} lbs/h		q_{max} lbs/h	
mm	inch	for 0 °C (32 °F) / 1013.25 hPa (14.696 psia)											
DN 25	1	0	...	160	0	...	120	0	...	350	0	...	350
DN 40	1.5	0	...	430	0	...	330	0	...	950	0	...	950
DN 50	2	0	...	700	0	...	540	0	...	1500	0	...	1500
DN 80	3	0	...	1700	0	...	1300	0	...	3700	0	...	3700

Type of gas		Carbon dioxide -25 ... 150 °C (-13 ... 302 °F)											
Nominal diameter		q_{min} kg/h		q_{max} kg/h		q_{min} Nm ³ /h		q_{max} Nm ³ /h		q_{min} lbs/h		q_{max} lbs/h	
mm	inch	for 0 °C (32 °F) / 1013.25 hPa (14.696 psia)											
DN 25	1	0	...	180	0	...	90	0	...	400	0	...	400
DN 40	1.5	0	...	440	0	...	220	0	...	970	0	...	970
DN 50	2	0	...	730	0	...	370	0	...	1600	0	...	1600
DN 80	3	0	...	1900	0	...	900	0	...	4200	0	...	4200

4.3 Ordering information

	Main Code										Add. Code	
	Variant digit No.	1 - 6	7	8	9	10	11	12	13	14		15
Sensyflow FMT400-VTCS Thermal Mass Flowmeter, Hygienic Version, for Gases, Integral mount Design	V14222	X	X	X	X	X	X	X	X	X	X	XXX
Sensor Unit Metal sensor, stainless steel	4)	1										
Version VTCS, Hygienic version, pipe screw connection S acc. to DIN 11851, nominal pressure PN 16 (16 bar / 1.6 MPa / 232 psi)					6							
VTCS, Hygienic version, FG flange, nominal pressure PN 10 (10 bar / 1 MPa / 145 psi)					8							
Operating Temperature Standard range -25 ... 150 °C (-13 ... 302 °F), hygienic version						0						
Measuring Medium Gases and gas mixtures with max. 23.5 Vol% O2						1)	0					
Oxygen/gas mixtures > 23.5 Vol% O2, oil and grease-free, with O2 certificate (max. 150 °C/302 °F)						2)	1					
Mounting Length / Material 120 mm (4.8 in.) / Stainless steel								4	0			
Analog Output 4 ... 20 mA, alarm < 3.5 mA										5)	1	
4 ... 20 mA, alarm > 22 mA										5)	2	
0 ... 20 mA										5)	3	
Number of Characteristic Curves 1 characteristic curve												1
Certificates: Calibration Factory certificate												0
DKD certificate of calibration with air (not for process gas calibration)												3) 1
Certificates and Material Traceability Material certificate 3.1 acc. EN 10204												CBB
Declaration of compliance with the order 2.1 acc. EN 10204												CF3
Certificates: GOST GOST Russia - metrological approval												CG1
GOST Kazakhstan - metrological approval												CG2
Language of Documentation German												M1
English												M5

Accessories	Code
FMT Power supply unit, Housing for rail mounting 62.5 mm x 75 mm x 139 mm, Input 230 V AC, Output 24 V DC / 2.5 A	7962800
FMT200-D / FMT400 LCI Adapter, Local Communication Interface for parameterization, incl. Communication software	7962828

- 1) Not for pure oxygen
- 2) Not for flange FG
- 3) PTB approved DKD calibration facility No. 05701
- 4) Only for FMT400-VTCS, Hygienic version
- 5) Changeable via LCI Adapter

						Main Code						Add. Code	
Variant digit No.						1 - 6	7	8	9	10	11		12
FMT082 Pipe component, for Sensyflow FMT400-VTCS						FMT082	X	X	X	X	X	X	XXX
Measuring Medium													
Gases, gas mixtures and natural gas (each max. 23.5 Vol% O ₂)							A						
Oxygen/gas mixtures > 23.5 Vol% O ₂ , oil and grease-free, with O ₂ certificate (max. 150 °C/302 °F)							B						
Design													
Pipe component for Sensyflow FMT400-VTCS							0						
Nominal Diameter													
DN 25 (1 in.)									A				
DN 40 (1-1/2 in.)									C				
DN 50 (2 in.)									D				
DN 80 (3 in.)									F				
Flange Style and Pressure Rating													
Pipe screw connection S acc. to DIN 11851, nominal pressure PN 16 (16 bar / 1.6 MPa / 232 psi)										6			
FG flange, nominal pressure PN 10 (10 bar / 1 MPa / 145 psi)									1)	8			
Process Connection for Flowmeter Sensor													
Standard Sensyflow flange with centering pin											A		
Material													
Stainless steel AISI 304 (1.4301), only with pipe screw connection S / nominal pressure PN 16												4	
Stainless steel AISI 316L (1.4404), only with FG flange / nominal pressure PN 10												5	
Certificates and Material Traceability													
Material certificate 3.1 acc. EN 10204													CBB CF3
Declaration of compliance with the order 2.1 acc. EN 10204													

1) Not available for Oxygen measurement

4.4 Additional ordering information for calibration

FMT400-VTS, FMT400-VTCS		
Gas component 1	Vol. %	(clear text)
Gas component 2	Vol. %	(clear text)
Gas component 3	Vol. %	(clear text)
Gas component 4	Vol. %	(clear text)
Gas component 5	Vol. %	(clear text)
Gas component 6	Vol. %	(clear text)
Gas component 7	Vol. %	(clear text)
Gas component 8	Vol. %	(clear text)
Gas component 9	Vol. %	(clear text)
Gas component 10	Vol. %	(clear text)
		Sum 100 %
Operating temperature		(clear text)
Operating pressure		(clear text)
Nominal diameter, Pipe inner diameter (mm)		(clear text)
Measuring range		(clear text)
Unit		(clear text)
Standard state (e.g. 0 °C, 1013 mbar)		(clear text)
Adjusted measuring range		(clear text)

5 Electrical connections

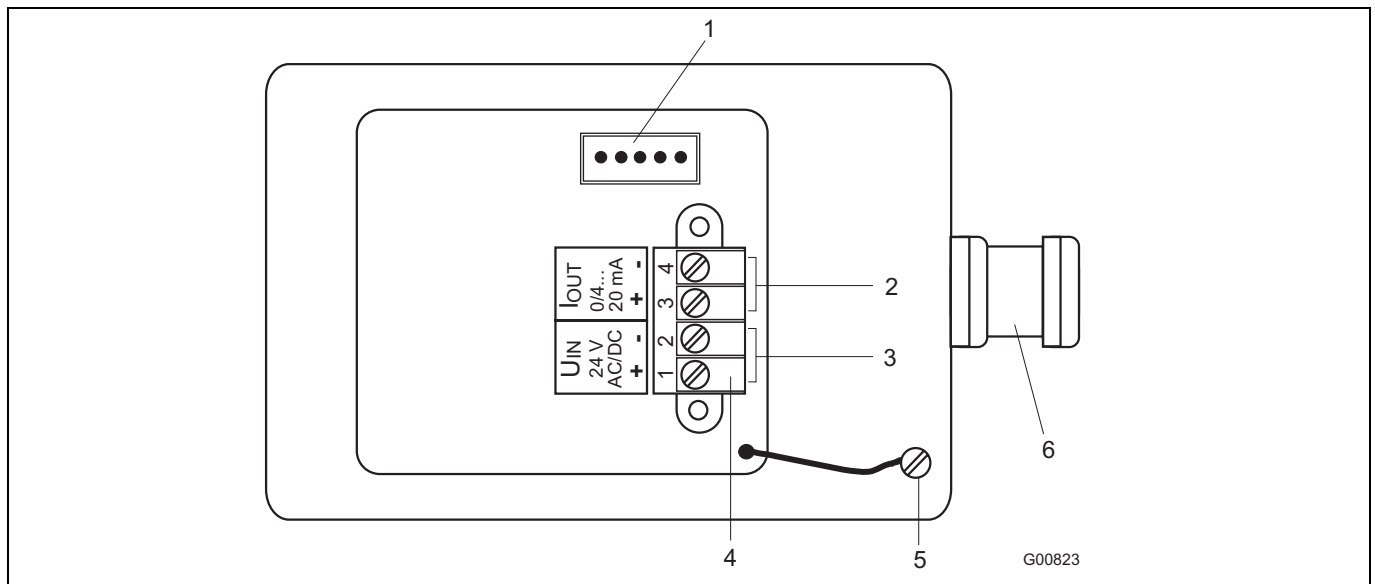
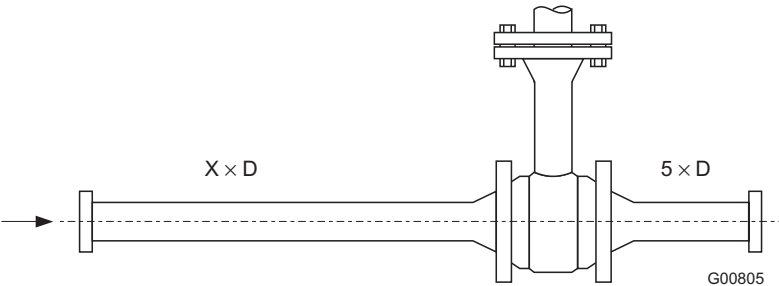
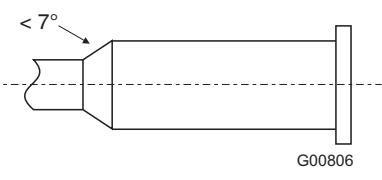
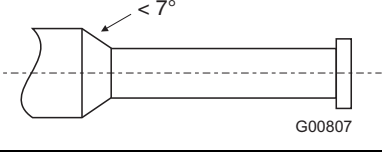
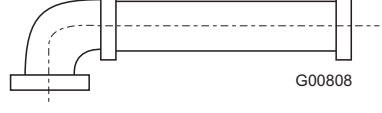
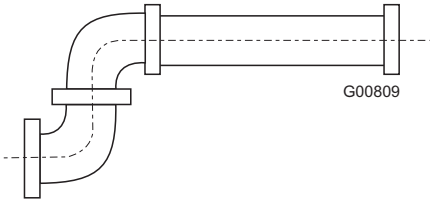
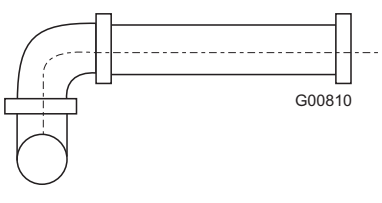



Fig. 10

- 1 Socket for LCI adapter
- 2 Analog output 0/4 ... 20 mA (electrically isolated)
- 3 Power supply 24 V AC/DC
- 4 Terminals
- 5 Ground
- 6 Cable entry

6 Recommended steadying lengths according to DIN EN ISO 5167-1

	
	<p>Expansion X = 15</p>
	<p>Reducer X = 15</p>
	<p>90° elbow X = 20</p>
	<p>Two 90° elbow in one level X = 25</p>
	<p>Two 90° elbow in two levels X = 40</p>
	<p>Valve / slide X = 50</p>

To achieve the stated measuring accuracy, the steadying lengths seen above must be provided. For combinations of inlet run disturbances, e.g. valve and reducer, you must always consider the longer inlet run length. In confined spaces at the mounting location the outlet run length can be shortened to $3 \times D$. The reduction of the minimum inlet run length, however, will impact on the achievable accuracy.

High repeatability of the measuring value is still provided. Under certain circumstances, special calibration can be performed for insufficient steadying lengths. For this purpose and in individual cases consulting is necessary.

For gases with extremely low density (hydrogen, helium) the steadying lengths must be doubled.

7 Questionnaire



Questionnaire
Thermal Mass Flowmeter
Sensyflow FMT

Customer address: _____
 Company: _____
 Zip code and location: _____ Date: _____
 Cust. no.: _____ Telephone: _____
 Contact person: _____ E-mail: _____

Media data for gaseous, pure media:

Description of media Mixed gas, gas composition in vol.%¹⁾

Type of gas (no mixtures): _____ Component 1/name/vol. %: _____
 Operating pressure (bar abs.) _____ Component 2/name/vol. %: _____
 Min./norm./max., approx. _____ Component 3/name/vol. %: _____
 Operating temperature (°C) _____ Component 4/name/vol. %: _____
 Min./norm./max., approx. _____ Component 5/name/vol. %: _____

Flowrate²⁾ Min.: _____ Norm.: _____ Max.: _____ **Pipeline/pipe component**³⁾

Flow unit:

	<i>Standard volume</i>	<i>Mass flow units</i>	DN/PN: _____
Nm ³ /h	<input type="checkbox"/>	kg/h	<input type="checkbox"/>
Nm ³ /min	<input type="checkbox"/>	kg/min	<input type="checkbox"/>
NI/min	<input type="checkbox"/>	g/min	<input type="checkbox"/>
SCFM	<input type="checkbox"/>	t/h	<input type="checkbox"/>
Other _____		Other _____	<input type="checkbox"/>

°Standard condition, e.g., 0°C/1,013 mbar or _____

ANSI/lbs _____
 Diameter [mm] _____
Inside diameter specified in mm
 Wafer flange form 1
 Partial meas. section form 2
 Weld-on adapter
 Other _____

Required device designs:

FMT500-IG <input type="checkbox"/>	FMT700-P ⁴⁾ <input type="checkbox"/>	Integral mount design <input type="checkbox"/>
FMT400-VTS <input type="checkbox"/>	FMT200-ECO2 <input type="checkbox"/>	Remote design with
FMT400-VTCS <input type="checkbox"/>	FMT200-D <input type="checkbox"/>	Cable length 5 m <input type="checkbox"/>
		Cable length 15 m <input type="checkbox"/>
		Cable length 25 m <input type="checkbox"/>

Output signal: 0/4...20 mA
 4...20 mA/HART
 PROFIBUS DP-V1

Ex protection class: None
 ATEX Zone 1/21
 ATEX Zone 0/21

Zone 2/22 24 V
 GOST 110 V
 FM/CSA 230 V

Comments:

1) Please specify the composition of mixed gases (e.g., North Sea natural gas: 1) CH₄ 90%, 2) C₂H₆ 5%, 3) N₂ 3%, 4) C₃H₈, 1%, 5) CO₂ 1%).
 2) Calibration is performed at the max. possible flow in the nominal size specified.
 3) Please observe/determine the minimum inflow and outflow sections.
 4) Output signal: 0...10 V as standard

Note: An order can only be confirmed and a delivery date specified once full technical clearance has been obtained.

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