Data Sheet 10/14-6.41-EN Rev. F

Sensyflow FMT500-IG
Thermal Mass Flowmeter

Direct measurement of gas mass flow
— No additional pressure and temperature compensation required

Digital measured value processing with improved signal quality

Wide measuring range up to 1:150
— Factory-calibrated, with (optional) DKD calibration certificate
— Process-calibrated with clean gases and gas mixtures (optional)

High measuring accuracy

Short response time ≤ 0.5 seconds

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 rectangular ducts
— Reliable and convenient hot tap fittings

Integral mount design with back-lit display

Remote design with separate wall housing

Communication
— PROFIBUS DPV1 or analog / HART signal

Diagnostic and alarm functions

Approvals for explosion protection
— ATEX
— FM / CSA
— GOST Russia

Contents

1 General information

1.1 Principle of operation and construction

Sensyflow FMT500-IG is a thermal flowmeter for gases. The measuring principle (hot-film anemometer) allows the direct determination of mass flow and gas temperature. Taking the standard density of the gases into consideration, the standard volume flow rate can be displayed without additional pressure and temperature compensation.

The integral mount design of the Sensyflow FMT500-IG metering system comprises a transmitter, flowmeter sensor and a pipe component. In the remote design the flowmeter sensor and the transmitter are connected via a max. 50 m (164 ft.) long cable. Depending on the version, the flowmeter sensor provides the measuring signals either as PROFIBUS or as analog / HART signals. The unit is operated either remotely via PROFIBUS / HART communication or locally by using a magnetic pen.

The pipe component is available for nominal pipe sizes ranging from DN 25 ... DN 200 and in various designs. It is also possible to install the flowmeter sensor directly in square ducts or pipes with any diameter via a weld-on adapter.

For many years, thermal gas-mass flowmeters with analog design have been established as complete process measuring devices in the chemical industry. The digital Sensyflow FMT500-IG represents a logical step in the consequent development of this well-proven technology.

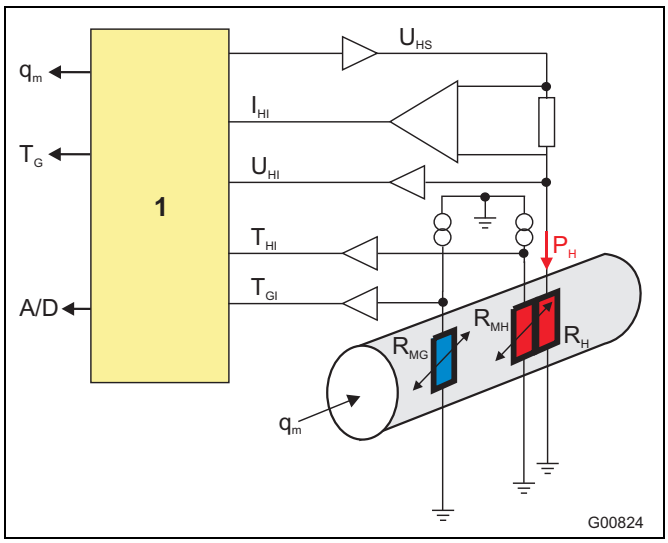


Abb. 1: Digital measuring principle of FMT500-IG

1 CPU and signal processing
q_m Gas mass flow
T_G Gas temperature
A/D Alarms, diagnostics
U_{HS} Heater setpoint
I_{HI} Process value of heater
U_{HI} Process value of heater
T_{HI} Process value of heater
T_{GI} Process value of gas
R_{MG} Gas temperature measuring resistor
R_{MH} Heater temperature measuring resistor
R_H Heating resistor
P_H Heating power

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. When using the constant power method, the temperature difference is measured which results from a constant heating power and depends on the heat quantitiy dissipated by the gas mass flow as well. 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.

The digital Sensyflow method

With the patented digital Sensyflow method there are 4 signals available to the evaluation electronics. These include, besides the heating power, the temperatures of the fluid and the heated sensor element, which can thus be used to compensate the temperature dependency on gas characteristics. By storing the gas data in the measuring system it is possible to calculate and perform an optimum adaptation at any operating time.

Advantages of the digital concept

- By providing several primary and secondary signals these signals can be output in parallel via the fieldbus connection. This makes a gas temperature measurement unnecessary.
- Through the implementation of complete digital signal processing it is possible to adapt the sensor control and signal conditioning to the process. This means that it is possible to achieve optimum measuring dynamics at all times, even under changing operating conditions.
- The digital Sensyflow method is capable of providing a further enhanced measuring range.
- While controlling the heater power at the same time, the temperature measurement of the heating resistor sets a limit of this temperature. If errors occur in the system resulting in gas temperatures beyond the specification, the heating power is switched off and the device sends a substitute value with an additional warning signal. Both measures result in a significant prolongation of the service life for high-temperature operation and enhanced equipment safety for the user.
- The most significant application and cost advantage results from the diagnostic features of the digital Sensyflow. The functions provided allow for preventive maintenance of the measuring system and the equipment, as operating times, temperature peaks and loads in the system can be evaluated, stored, and reported. This leads to direct cost savings by preventing failures and equipment downtime.

Typical applications

- Gas volume measurement in chemical industry and process technology
- Compressed air balancing
- Gas burner control systems
- Biogas and activation air measurement in sewage plants
- Gas measurement at air decomposers
- Hydrogen measurement in the process

1.2 Type overview

Type	FMT500-IG	FMT500-IG Ex version
Application	Process engineering	
Measured gases	Gases and gas mixtures with known composition	
Explosion protection	Manufacturer's declaration ATEX II 3 G and II 3 D, Zone 2/22	Certificate KEMA 03ATEX2100 ATEX II 1/2 G and II 2 D, Zone 0, 1, 21 GOST Russia Zone 0 and 1 FM/CSA Cl.1 Div. 1 or Cl.1 Div. 2
Design / Dimensions / Weight	dependent on nominal size	
Materials (standard)	Stainless steel, ceramic sensor (other materials on request)	
Process connection (standard)	Flange according to EN1092-1 Form B1, PN 40 (DIN 2635 Form C) or ASME B 16.5 Cl. 150 / 300	
System components	Transmitter Flowmeter sensor Pipe component design 1 or 2 or weld-on adapter	
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“)	
Degree of protection	IP 67 (IP 66 for flowmeter sensor remote design)	

Equipment and functions

- Graphic display, back-lit, 120 x 32 pixels
- Mass flow or standard volume flow measurement, digital or bargraph display indication
- Totalizer function (adding counter) with Start / Stop, Reset and Preset function
- Gas temperature measurement
- 4 characteristic curves for different gases or pipe diameters (optional)
- Max. / min. value storage of flow rate, gas and housing temperature
- Alarm and limit value functions
- Status and diagnostic signals
- Operating hour meter
- Simulation of measured values and status signals
- On-site adaption of measuring value practicable by user
- Password-protected input menus
- 4 display languages
- Local operation by using a magnetic pen
- FDT / DTM for parameter setting via DSV4xx (SMART VISION) or process control system
- “Easy set-up” menu for user-friendly commissioning (analog / HART version)
- Manufacturer's declaration regarding safety-related information according to IEC 61508 for analog / HART version (optional)

PROFIBUS communication, DPV1 version

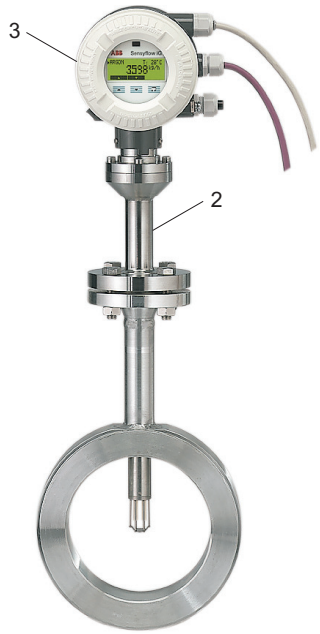
- in acc. with PA profile 3.0, max. transmission rate 1.5 Mbaud, direct connection to an intrinsically safe PROFIBUS DP in the hazardous area is possible

Signal inputs and outputs, analog / HART version

- HART communication via 4 ... 20 mA analog signal
- Current output for flow rate value
- 2 open collector digital outputs, configurable as
  - frequency output for flow rate and gas temperature
  - pulse output for totalizer (adding counter)
  - contact output for limit values and single or general alarm
- 2 digital inputs, configurable for / as
  - external change-over of characteristic curve
  - Totalizer start / stop or reset
- 24 V DC output for input/output wiring or for transmitter supply (max. 30 mA , not for explosion-proof versions).

1.3 Overview of Sensyflow FMT500-IG

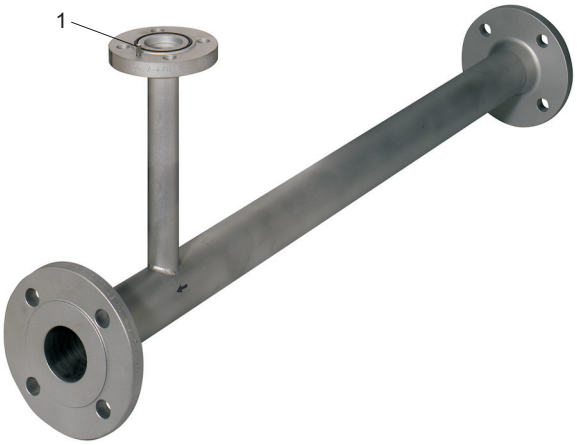
Integral mount design with display



Pipe component design 1
in wafer flange version
DN 40 ... DN 200 / ASME 1 1/2 ... 8“

Remote design with transmitter in field housing

Integrated hot tap fitting in
wafer flange version
DN 50 ... DN 200 / ASME 2 ... 8“



Pipe component design 2 as partial measuring section
DN 25 ... DN 80 / ASME 1 ... 2“

Weld-on adapter
from DN 100 / ASME 4“

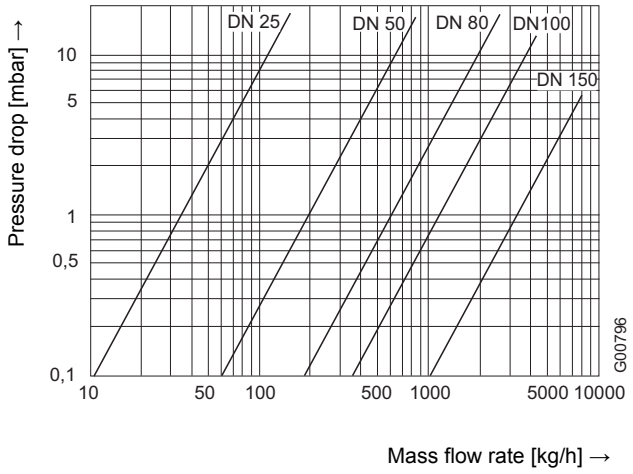
Weld-on adapter with ball valve
from DN 100 / ASME 4“

Abb. 2

1 Centering pin on outlet side
2 Flowmeter sensor FMT500-IG
3 Transmitter
4 Connection box

2 Specifications

Type	**FMT500-IG**				**FMT500-IG Ex version**			
Measured variable (measured gases)	Flow rate of gases and gas mixtures with known composition							
Measuring ranges Nominal diameters (DN)	**q_{min} kg/h**	**q_{max} kg/h**	**q_{min} Nm³/h** for 0 °C (32 °F) / 1013.25 hPa (14.696 psia)	**q_{max} Nm³/h**	**q_{min} kg/h**	**q_{max} kg/h**	**q_{min} Nm³/h** for 0 °C (32 °F) / 1013.25 hPa (14.696 psia)	**q_{max} Nm³/h**
DN 25	0 ...	180	0 ...	140	0 ...	160	0 ...	120
DN 40	0 ...	450	0 ...	350	0 ...	430	0 ...	330
DN 50	0 ...	750	0 ...	580	0 ...	700	0 ...	540
DN 65	0 ...	1,400	0 ...	1,100	0 ...	1,200	0 ...	920
DN 80	0 ...	2,000	0 ...	1,500	0 ...	1,700	0 ...	1,300
DN 100	0 ...	3,200	0 ...	2,500	0 ...	3,000	0 ...	2,300
DN 125	0 ...	5,600	0 ...	4,300	0 ...	5,100	0 ...	3,900
DN 150	0 ...	9,000	0 ...	7,000	0 ...	8,000	0 ...	6,200
DN 200	0 ...	15,000	0 ...	12,000	0 ...	13,000	0 ...	10,000
up to 3000 mm	0 ...	3,000,000	0 ...	2,300,000	0 ...	2,700,000	0 ...	2,100,000
(Rectangular ducts and larger diameters on request)								
Measuring ranges Nominal diameters (inch)	**q_{min} lbs/h**	**q_{max} lbs/h**	**q_{min} SCFM** for 15 °C (59 °F) / 1013.25 hPa (14.696 psia)	**q_{max} SCFM**	**q_{min} lbs/h**	**q_{max} lbs/h**	**q_{min} SCFM** for 15 °C (59 °F) / 1013.25 hPa (14.696 psia)	**q_{max} SCFM**
1.0	0 ...	350	0 ...	75	0 ...	310	0 ...	65
1.5	0 ...	880	0 ...	190	0 ...	860	0 ...	185
2.0	0 ...	1,500	0 ...	330	0 ...	1,400	0 ...	310
3.0	0 ...	4,000	0 ...	860	0 ...	3,300	0 ...	720
4.0	0 ...	6,400	0 ...	1,400	0 ...	6,000	0 ...	1,300
6.0	0 ...	18,500	0 ...	4,000	0 ...	16,500	0 ...	3,600
8.0	0 ...	32,000	0 ...	6,900	0 ...	27,500	0 ...	6,000
120.0	0 ...	6,600,000	0 ...	1,400,000	0 ...	6,000,000	0 ...	1,300,000
(Rectangular 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	Under calibration conditions in the stated measuring range							
Air, nitrogen other gases	± 0.9 % of measured value ± 0.05 % of possible end value in this nominal size (see measuring ranges) ± 1.8 % of measured value ± 0.10 % of possible end value in this nominal size (see measuring ranges) Special calibration on request							
Repeatability	< 0.2 % 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 for Zone 2/22 version with constant power				T_{63} = 2 s			

Type	FMT500-IG	FMT500-IG Ex version
Operating conditions		
Recommended inlet and outlet runs	According to DIN EN ISO 5167-1 Minimum inlet run 15 x pipe diameter D, outlet run 5 x pipe diameter D	
Environmental conditions		
Ambient temperature Transmitter Flowmeter sensor remote design	-25 ... 50 °C (-13 ... 122 °F) for zone 2/22 versionen: -20...50 °C (-4 ... 122 °F) -25 ... 80 °C (-13 ... 176 °F) for zone 2/22 versionen: -20 ... 80 °C (-4 ... 176 °F)	-20 ... 50 °C (-4 ... 122 °F) -20 ... 80 °C (-4 ... 176 °F)
	Other ambient temperatures on reques	
Storage temperature	-25 ... 85 °C (-13 ... 185 °F)	
Type of protection	IP 67 (IP 66 for flowmeter sensor remote design)	
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 ... 150 °C (-4 ... 302 °F)	acc. to temperature classes of Ex certificates max. -20 ... 150 °C (-4 ... 302 °F) (-40 °C version on request)
Operating pressure	4 x 10^6 Pa (40 bar [580 psi])	
Pressure loss (logarithmic diagram)	< 1.0 kPa (10 mbar [0.1450 psi]), typical value 0.1 kPa (1 mbar [0.0145 psi])  	
Power supply		
Voltage	Universal power supply unit: 110 ... 230 V AC/DC ± 10 % (f = 48 ... 62 Hz) Low-voltage power supply unit: 24 V AC/DC ± 20 % (f = 48 ... 62 Hz)	
Power consumption	20 VA, current consumption 800 mA, slow-blow fuse of at least 2 A required	
Cable entry	M20 x 1.5 or 1/2“ NPT	
Output		
Analog- / HART version Analog output Digital outputs Digital inputs	0/4 ... 20 mA, load < 600 Ω (IG-Ex < 400 Ω), electrical isolated, alert < 3.5 or > 22 mA 2 x passive optocoupler (approx. 100 mA) can be used as frequency, pulse or contact output 2 x 24 V lin typ. 10 mA (low < 2 mA, high > 10 mA) contact input	
Installation class	Overvoltage category III, degree of pollution 2	

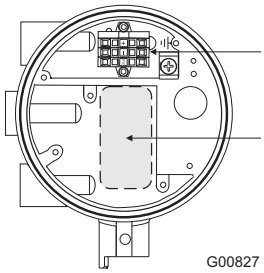
3 Electrical connections

3.1 Standard and zone 2/22 version

Transmitter integral mount design

L / + Phase / + terminal
N / - Neutral / - terminal
PE Earthing

Universal power supply unit 110 ... 230 V AC/DC ± 10 %
or
Low-voltage power supply unit 24 V AC/DC ± 20 %

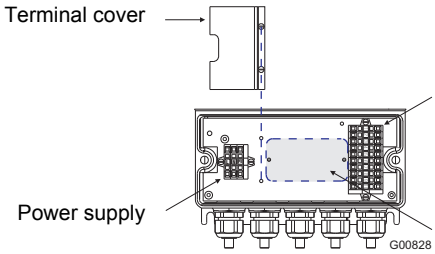


Transmitter remote design

L / + Phase / + terminal
N / - Neutral / - terminal
PE Earthing

Universal power supply unit 110 ... 230 V AC/DC ± 10 %
or
Low-voltage power supply unit 24 V AC/DC ± 20 %

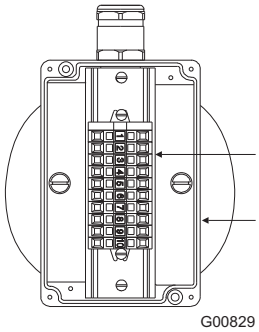
1:1 cable link from the terminal block of transmitter to the terminal block of flowmeter sensor, terminals 1 ... 10 (terminal 6 not used)



Flowmeter sensor remote design

Flowmeter sensor	terminal 1 ... 10
Cable	min. 9-wire
Min. size	min. 0.5 mm² AWG 20
Max. cable length	50 m (164 ft.) (25 m [82 ft.] max. for zone 2/22 version with constant power)

1:1 cable link from the terminal block of transmitter to the terminal block of flowmeter sensor, terminals 1 ... 10 (terminal 6 not used)

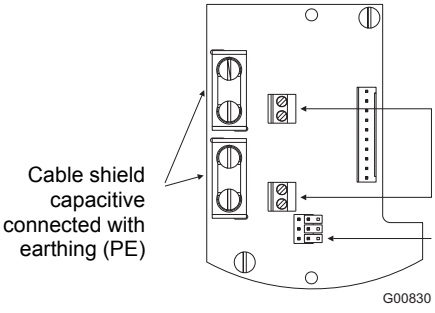


PROFIBUS module

A PROFIBUS DPV1 in/out signal
B PROFIBUS DPV1 in/out signal

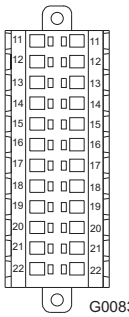
Note:
When disconnecting the PROFIBUS cable from the device, the entire PROFIBUS communication will be interrupted, due to the system properties. For details on an alternative solution see the version with DP M12 connector socket.

[1] Annotation on terminating resistors: The bus termination should only be activated by setting the respective jumpers if the device is the only bus station on this PROFIBUS branch.



Analog / HART module

11	Cable shield
12	+ I_{out} analog output / HART
13	- I_{out} analog output / HART
14	+ 24 V DC for external power supply, 30 mA max.
15	GND 24 V
16	D_{out} 1
17	D_{out} 2
18	GND D_{out} (D_{out} 1 + 2)
19	D_{in} 1
20	D_{in} 2
21	GND D_{in} (D_{in} 1 + 2)
22	Cable shield

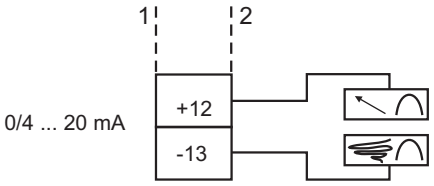


3.1.1 Designation

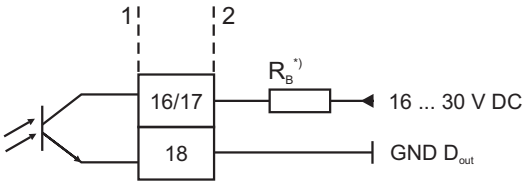
Transmitter with remote mount design	Flowmeter sensor with remote mount design	Integral mount design
II 3G EEx nA II T4 **II 3D IP 67 T 115 °C** T_{amb} = -20 ... 50 °C (-4 ... 122 °F)	**II 3G EEx nA II T4** **II 3D IP 66 T 150 °C** T_{amb} = -20 ... 80 °C (-4 ... 176 °F) T_{medium} = -20 ... 150 °C (-4 ... 302 °F)	**II 3G EEx nA II T4** **II 3D IP 67 T 150 °C** T_{amb} = -20 ... 50 °C (-4 ... 122 °F) T_{medium} = -20 ... 150 °C (-4 ... 302 °F)

3.1.2 Examples for connecting peripherals (Analog / HART version)

Active direct current output



Passive digital outputs, optocoupler



Can be used as frequency, pulse or contact output
*) $R_B \leq U_{ce} / I_{ce}$

Digital inputs

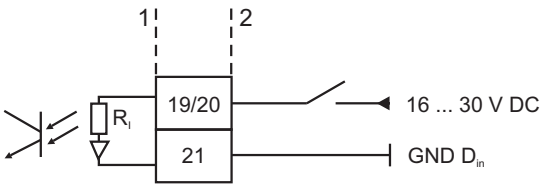


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Abb. 3

1 Internal 2 External

3.1.3 PROFIBUS DPV1 communication with DP M12 connector socket

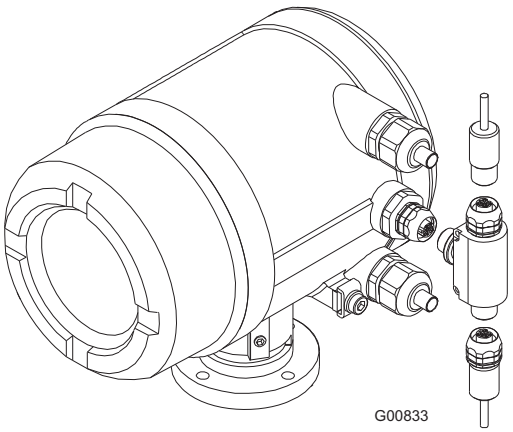
The version with PROFIBUS DP M12 connector socket allows disconnection of the device from the bus without interrupting PROFIBUS DP operation. Instead of the center cable gland an assembled and wired DP M12 connector socket is supplied.

For connection to the PROFIBUS DP line you need 1 T-plug, cable socket and cable plug (see accessories).

Type of protection of the plug-in connections: IP 66.

Only available for non-Ex devices in integral mount design.

Please refer to Data Sheet 10/63-6.40 for other versions of T-plugs and appropriate DP connector plugs.



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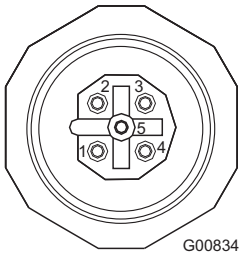

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Pin assignment of the device

Pin	Signal	Description
1	VP	+ 5 V
2	RxD/TxD-N	Receive / transmit data line A (green wire)
3	DGND	Data transmission potential
4	RxD/TxD-P	Receive / transmit data line B (red wire)
5	Shield	Shield / protective earth
Thread	Shield	Shield / protective earth

3.2 Versions for hazardous areas according to ATEX, GOST Russia and FM / CSA

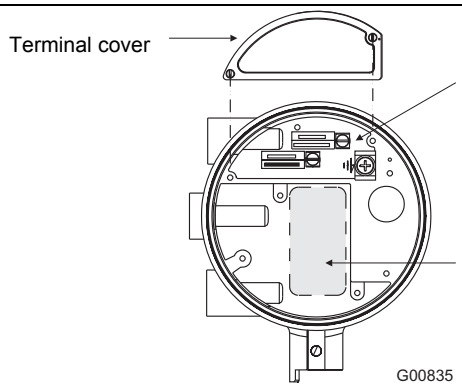
Transmitter integral mount design

L / + Phase / + terminal
N / - Neutral / - terminal
PA Potential equalization

Universal power supply unit 110 ... 230 V AC/DC ± 10 %, 20 VA
48 ... 62 Hz, U_{max} = 250 V or

Low-voltage power supply unit 24 V AC/DC ± 20 %, 20 VA
48 ... 62 Hz, U_{max} = 29 V

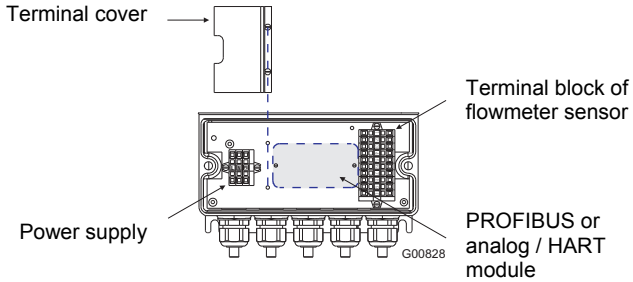
Type of protection for power terminals: Ex e (ATEX, GOST), XP (FM, CSA)



Transmitter remote design

L / + Phase / + terminal
N / - Neutral / - terminal
PE Earthing
Universal power supply unit 110 ... 230 V AC/DC ± 10 %, 20 VA
48 ... 62 Hz, U_{max} = 250 V oder
Low-voltage power supply unit 24 V AC/DC ± 20 %, 20 VA
48 ... 62 Hz, U_{max} = 29 V
1:1 cable link from the terminal block of transmitter to the terminal block of flowmeter sensor, terminals 1 ... 10 (terminal 6 not used)

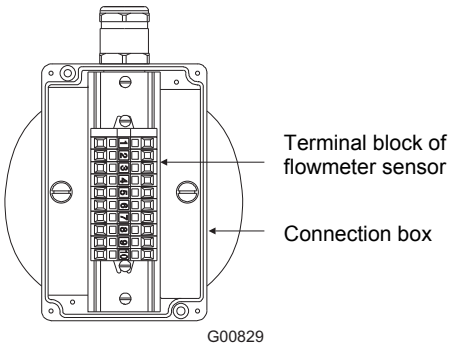
Type of protection for flowmeter sensor connection Ex ia (ATEX, GOST), IS (FM, CSA)



Flowmeter sensor remote design

Type of protection	Ex ia (ATEX, GOST), IS (FM, CSA)
Flowmeter sensor	terminal 1 ... 10
Cable	min. 9-wire
Min. size	min. 0.5 mm² AWG 20
Max. cable length	25 m (82 ft.)

1:1 cable link from the terminal block of transmitter to the terminal block of flowmeter sensor, terminals 1 ... 10 (terminal 6 not used)

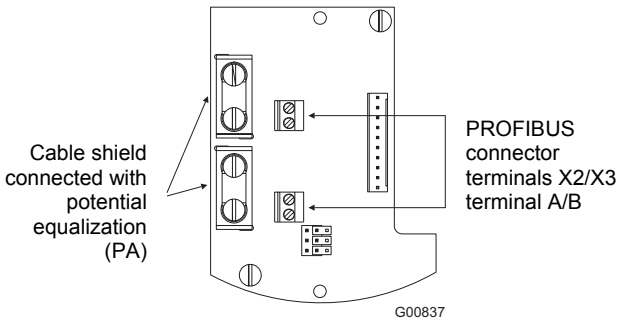


PROFIBUS module

A PROFIBUS DPV1 in / out signal
B PROFIBUS DPV1 in / out signal
Type of protection Ex ib (ATEX, GOST), IS (FM, CSA)

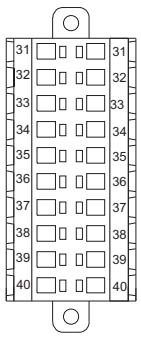
May be connected to an intrinsically safe PROFIBUS DP, only (integral mount design and remote design).
Bus termination internally via 150 Ω resistance or externally according to RS485 IS specification.

For the field bus / signal lines, the safety-related parameters in the relevant certificates must be observed.



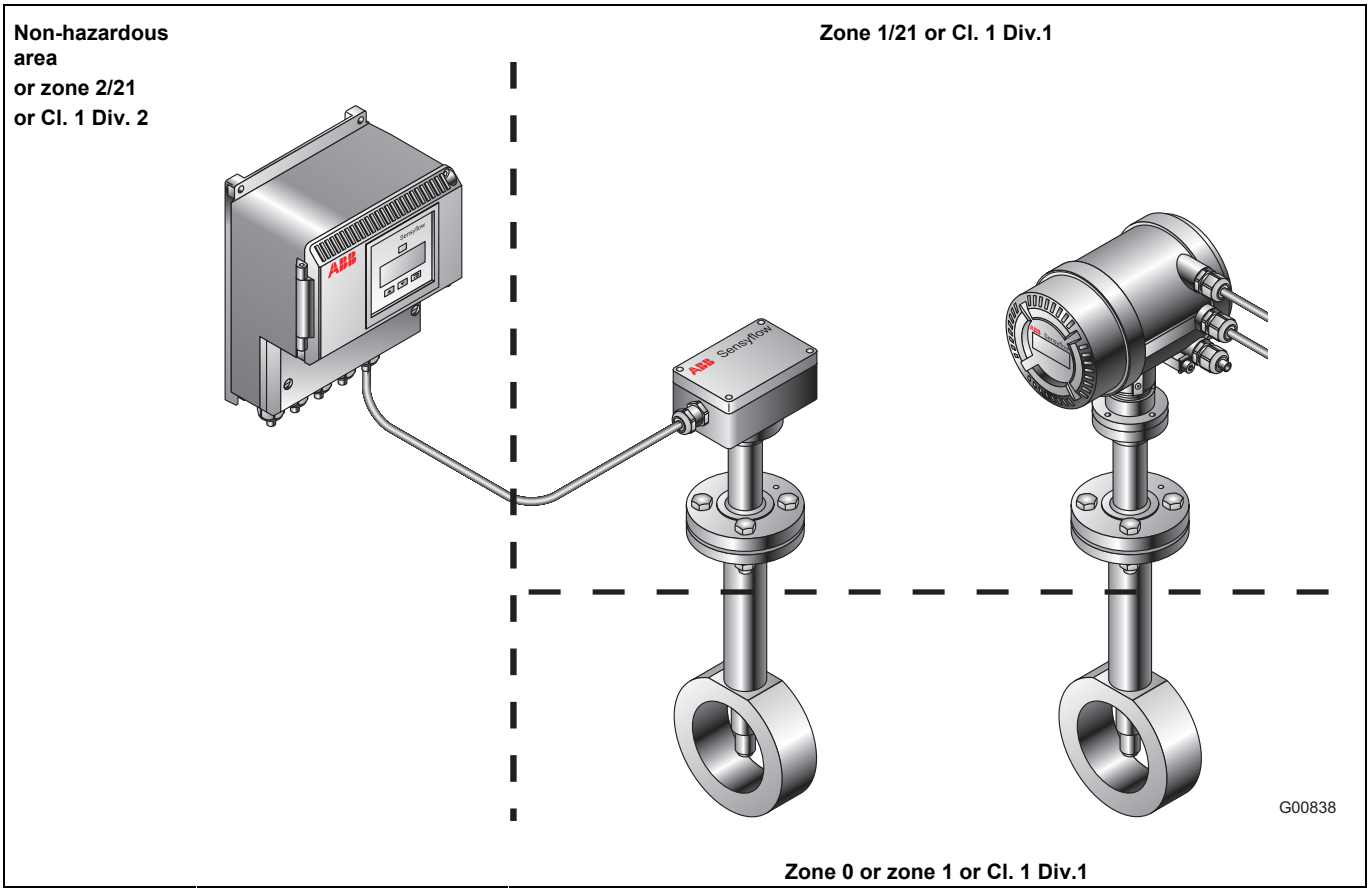
Analog / HART module

31 + I_{out} analog output / HART
32 - I_{out} analog output / HART
33 D_{out} 1
34 GND D_{out} (D_{out} 1)
35 D_{out} 2
36 GND D_{out} (D_{out} 2)
37 D_{in} 1
38 GND D_{in} (D_{in} 1)
39 D_{in} 2
40 GND D_{in} (D_{in} 2)
Type of protection: Ex ib or Ex e (ATEX, GOST), IS or XP, NI (FM, CSA)
For the field bus / signal lines, the safety-related parameters in the relevant certificates must be observed.



4 Ex relevant specifications

4.1 Mounting in hazardous areas



4.2 ATEX designation

Transmitter remote design	Flowmeter sensor remote design	Integral mount design
Zone 2/21 **II 3(1) G EEx nA [ia] [ib] IIC T4** **II 2 D T 115 °C** T_{amb} = -20 ... 50 °C (-4 ... 122 °F) Optionally -40 °C for ambient temperature	Connection box zone 1, flowmeter sensor zone 0 **II 1/2 G EEx ia IIC T4** **II 2 D T 80 °C** Connection box and flowmeter sensor zone 1 **II 2 G EEx ia IIC T4...T1** **II 2 D T 100 °C or 200 °C or 300 °C** T_{amb} = -20 ... 80 °C (-4 ... 176 °F) Optionally -40 °C for ambient temperature	Transmitter zone 1, flowmeter sensor zone 0 **II 1/2 G EEx de [ia] [ib] IIC T4** **II 2 D T 115 °C** Transmitter and flowmeter sensor zone 1 **II 2 G EEx de [ia] [ib] IIC T4...T1** **II 2 D T 115 °C or 200 °C or 300 °C** T_{amb} = -20 ... 50 °C (-4 ... 122 °F) Optionally -40 °C for ambient temperature

4.3 GOST Russia designation

Transmitter remote design	Flowmeter sensor remote design	Integral mount design
2Ex nA [ia] [ib] IIC T4 or **2Ex nA [ia] IIC T4** **DIP A21 T_A115 °C, IP 67**	Connection box zone 1, flowmeter sensor zone 0 **Ex ia IIC T4** **DIP A21 T_A80 °C, IP 66** Connection box and flowmeter sensor zone 1 **Ex ia IIC T4...T1** **DIP A21 T_A100 / 200 / 300 °C, IP 66**	Transmitter zone 1, flowmeter sensor zone 0 **2Ex de [ia] [ib] IIC T4 or** **2Ex de [ia] IIC T4** **DIP A21 T_A115 °C, IP 67** Transmitter and flowmeter sensor zone 1 **2Ex de [ia] [ib] IIC T4...T1 or** **2Ex de [ia] IIC T4...T1** **DIP A21 T_A100 / 200 / 300 °C, IP 67**
T_{amb} = -20 ... 50 °C (-4 ... 122 °F)	T_{amb} = -20 ... 80 °C (-4 ... 176 °F)	T_{amb} = -20 ... 50 °C (-4 ... 122 °F)

4.4 Temperature table for ATEX and GOST Russia versions

Sensyflow FMT500-IG integral mount design				
Temperature class	Surface temperature	Process temperature	Flowmeter sensor	Transmitter
T4	T 115 °C	-20 ... 80 °C (-4 ... 176 °F)	Cat. 1G / zone 0	Cat. 2G/2D / zone 1/21
T4	T 115 °C	-20 ... 100 °C (-4 ... 212 °F)	Cat. 2G / zone 1	Cat. 2G/2D / zone 1/21
T3	T 115 °C	-20 ... 100 °C (-4 ... 212 °F)	Cat. 2G / zone 1	Cat. 2G/2D / zone 1/21
T2	T 200 °C[1)]	-20 ... 200 °C (-4 ... 392 °F)[1)]	Cat. 2G / zone 1	Cat. 2G/2D / zone 1/21
T1	T 300 °C[1)]	-20 ... 300 °C (-4 ... 572 °F)[1)]	Cat. 2G / zone 1	Cat. 2G/2D / zone 1/21
Sensyflow FMT500-IG Transmitter remote design				
Temperature class	Surface temperature			Transmitter
T4	T 115 °C			Cat. 3G/2D / zone 2/21
Sensyflow FMT500-IG Flowmeter sensor remote design				
Temperature class	Surface temperature	Process temperature	Flowmeter sensor	Connection box
T4	T 80 °C	-20 ... 80 °C (-4 ... 176 °F)	Cat. 1G / zone 0	Cat. 2G/2D / zone 1/21
T4	T 100 °C	-20 ... 100 °C (-4 ... 212 °F)	Cat. 2G / zone 1	Cat. 2G/2D / zone 1/21
T3	T 100 °C	-20 ... 100 °C (-4 ... 212 °F)	Cat. 2G / zone 1	Cat. 2G/2D / zone 1/21
T2	T 200 °C[1)]	-20 ... 200 °C (-4 ... 392 °F)[1)]	Cat. 2G / zone 1	Cat. 2G/2D / zone 1/21
T1	T 300 °C[1)]	-20 ... 300 °C (-4 ... 572 °F)[1)]	Cat. 2G / zone 1	Cat. 2G/2D / zone 1/21

[1)] Temperatures correspond to ATEX / GOST Russia temperature classes, max. process temperature for flowmeter sensor -20 ... 150 °C (-4 ... 302 °F)

4.5 FM designation with temperature information

Transmitter remote design	Flowmeter sensor remote design	Integral mount design
NI CLASS I DIV2 Group: A,B,C,D, CLASS I Zone 2 AEx nA IIC T4...T1 **DIP CLASS II, III DIV1 and 2 Group: E,F,G** **IS Circuits for CLASS I DIV1 Group: A,B,C,D, CLASS I Zone 0 AEx ia IIC**	**IS CLASS I DIV1 Group: A,B,C,D, CLASS I Zone 0 AEx ia IIC T4...T1** **DIP CLASS II, III DIV1 and 2 Group: E,F,G** **NI CLASS I, II, III DIV2, Group: A,B,C,D, CLASS I Zone 2 Group: IIC T4...T1**	**XP CLASS I DIV1 Group: B,C,D, CLASS I, Zone 1 II B T4...T1** **IS Circuits for CLASS I DIV1 Group: B,C,D, CLASS I Zone 0 AEx ia IIC** **DIP CLASS II,III DIV1 and 2 Group: E,F,G** **NI CLASS I, II, III DIV2, Group: A,B,C,D,F,G, CLASS I Zone 2 Group: IIC T4...T1**
T_{amb} = -20 ... 50 °C (-4 ... 122 °F)	T_{amb} = -20 ... 80 °C (-4 ... 176 °F) T_{medium} = -20 ... 150 °C (-4 ... 302 °F) $T4/T3_{medium}$ = -20 … 100 °C (-4 ... 212 °F) $T2_{medium}$ = -20 … 200 °C (-4 ... 392 °F) $T1_{medium}$ = -20 … 300 °C (-4 ... 572 °F)	T_{amb} = -20 ... 50 °C (-4 ... 122 °F) T_{medium} = -20 ... 150 °C (-4 ... 302 °F) $T4/T3_{medium}$ = -20 … 100 °C (-4 ... 212 °F) $T2_{medium}$ = -20 … 200 °C (-4 ... 392 °F) $T1_{medium}$ = -20 … 300 °C (-4 ... 572 °F)

4.6 CSA designation with temperature information

Transmitter remote design	Flowmeter sensor remote design	Integral mount design
CLASS I DIV2, Group: A,B,C,D, CLASS I Zone 2 Ex nA II T4...T1 **CLASS II, III DIV1 and 2 Group: E,F,G** **Associated Equipment [Ex ia] CLASS I DIV1 Group: A,B,C,D [Ex ia] IIC**	**Intrinsically safe Exia CLASS I DIV1 Group: A,B,C,D, Ex ia IIC T4...T1** **CLASS II, III DIV1 and 2 Group: E,F,G** **CLASS I DIV2, Group: A,B,C,D, Ex nA II T4...T1**	**CLASS I DIV1 Group: B,C,D,F,G, CLASS I, Zone 1 II B T4...T1** **CLASS I Zone 1/0 Ex d [ia] [ib] IIC T4...T1 or Ex d [ia] IIC T4...T1** **CLASS II, III DIV1 and 2 Group: E,F,G** **CLASS I, II, III DIV2, Group: A,B,C,D,F,G, CLASS I Zone 2 Ex nA II T4...T1**
T_{amb} = -20 ... 50 °C (-4 ... 122 °F)	T_{amb} = -20 ... 80 °C (-4 ... 176 °F) T_{medium} = -20 ... 150 °C (-4 ... 302 °F) $T4/T3_{medium}$ = -20 … 100 °C (-4 ... 212 °F) $T2_{medium}$ = -20 … 200 °C (-4 ... 392 °F) $T1_{medium}$ = -20 … 300 °C (-4 ... 572 °F)	T_{amb} = -20 ... 50 °C (-4 ... 122 °F) T_{medium} = -20 ... 150 °C (-4 ... 302 °F) $T4/T3_{medium}$ = -20 … 100 °C (-4 ... 212 °F) $T2_{medium}$ = -20 … 200 °C (-4 ... 92 °F) $T1_{medium}$ = -20 … 300 °C (-4 ... 572 °F)

4.7 Safety Specifications for the Inputs and Outputs, Model FCM2000-MC27B

4.7.1 PROFIBUS DPV1 communication

Output circuit	ATEX and GOST versions: Intrinsically safe EEx ib IIC / IIB FM/CSA versions: IS acc. to control drawings V14224-6 ... 1222 ..., V14224-6 ... 2222 ..., V14224-7 ... 1122 ..., V14224-7 ... 2122 ...			
PROFIBUS DP	U_o = ± 3.72 V			
RS 485_IS interface	I_o	P_o	EEx ib IIC/IIB	
Terminals X2, X3	[mA]	[mW]	C'[nF/km]	L'/R'[mH/Ω]
Terminal A/B	± 155	± 144.2	≤ 250	≤ 28.5
	Min. cable cross section 0.2 mm Max. input voltage U_i: ± 4.20 V C_i: 0 nF Max. input current I_i: ± 2.66 A L_i: 0 mH Electrical isolation of RS 485_IS PROFIBUS fieldbus signals A and B Cable shield is connected to potential equalization Use approved RS 485_IS interface / barriers only to disconnect intrinsically safe and non-intrinsically safe PROFIBUS connections			

4.7.2 Analog / HART communication

<table>
<tr><td>Output circuit</td><td colspan="4">ATEX and GOST versions: Intrinsically safe EEx ib IIC / IIB

FM / CSA versions:
IS acc. to control drawings
V14224-6 ... 1212 ... IS, V14224-6 ... 2212 ... IS,
V14224-7 ... 1112 ... IS, V14224-7 ... 2112 ... IS</td><td>ATEX and GOST versions: Non-intrinsically safe
U_{max} = 60 V
FM / CSA versions:
XP, NI, DIP acc. to control drawings
V14224-6 ... 1212 ..., V14224-6 ... 2212 ...,
V14224-7 ... 1112 ..., V14224-7 ... 2112 ...
U_{max} = 90 V</td></tr>
<tr><td rowspan="4">Current output
Active
Terminal 31 + 32</td><td>U_o = 17.2 V</td><td>U_i = 30 V</td><td>I_i = 100 mA</td><td></td><td>U_B = 30 V</td></tr>
<tr><td>I_o</td><td>P_o</td><td colspan="2">EEx ib IIC</td><td>I_B = 30 mA</td></tr>
<tr><td>[mA]</td><td>[mW]</td><td>C_i [nF]</td><td>L_i [mH]</td><td></td></tr>
<tr><td>78.3</td><td>337</td><td>2.0</td><td>0.25</td><td></td></tr>
<tr><td></td><td colspan="4">Characteristic curve: Linear
C_o = 353 nF, L_o = 4 mH
Connect to passive, intrinsically safe circuits only.
Terminal 32 is connected to potential equalization (PA).
Use only approved separators / barriers.</td><td></td></tr>
<tr><td>Digital output
Passive
$D_{out}1$: Terminal 33 + 34
D_{out2}: Terminal 35 + 36</td><td colspan="2">U_i = 15 V
I_i = 30 mA
P_i = 115 mW</td><td colspan="2">C_i = 2.0 nF
L_i = 0.250 mH</td><td>U_B = 30 V
I_B = 100 mA</td></tr>
<tr><td>Digital input
Passive
$D_{in}1$: Terminal 37 + 38
$D_{in}2$: Terminal 39 + 40</td><td colspan="2">U_i = 30 V
I_i = 250 mA
P_i = 1.1 W</td><td colspan="2">C_i = 2.0 nF
L_i = 0.250 mH</td><td>U_B = 30 V
I_B = 100 mA</td></tr>
</table>

Special requirements:

The output current circuits are designed such that they can be connected to either intrinsically safe or non-intrinsically safe current circuits. However, intrinsically safe and non-intrinsically safe circuits must not be mixed or combined.

The rated voltage of non-intrinsically safe current circuits is:

- for ATEX and GOST versions U_m = 60 V
- for FM and CSA versions U_m = 90 V (XP, NI, DIP).

- Make sure that the cover of the power terminal box is always closed properly. When using the device with intrinsically safe output current circuits it is permissible to open the terminal box.
- It is recommended to use the enclosed cable glands for the output current circuits, according the type of explosion protection: intrinsically safe = blue; non-intrinsically safe = black.
- The flowmeter sensor and the transmitter housing must be connected to an equipotential bonding system. When using intrinsically safe current outputs proper equipotential bonding must be ensured along the current circuits.
- Make sure that the measuring pipe materials are resistant to possible corrosive substances in the measuring medium. This is the user's responsibility.

Notice:

The values indicated here are taken from the respective approval certificates. Always observe the specifications and supplements in the approvals (ATEX, FM, CSA, GOST Russia).

5 Communication

5.1 HART

HART protocol Rev. 6.0 is used for digital communication between a process control system or PC, a hand-held terminal and the field device. It can be used to send all device and measuring point parameters from the transmitter to the process control system or PC. Conversely, it also provides a means of reconfiguring the transmitter.

Digital communication utilizes an alternating current superimposed on the analog output (4 ... 20 mA) that does not affect any meters connected to the output.

To operate and configure the meter, the DSV401 (SMART VISION) program can be used. This is a piece of universal communication software for intelligent field devices based on FDT / DTM technology. Data can be exchanged with a comprehensive range of field devices using various means of communication. The main applications include parameter display, configuration, diagnostics, recording, and data management for all intelligent field devices that specifically meet the communication requirements involved.

Basic functions (such as the measuring range end value or certain mass flow units) can be parameterized with the universal HART DTM. If you use the FMT500-IG HART DTM, you will have access to the full range of functions.

Transmission method

FSK modulation at current output of 4 ... 20 mA based on the Bell 202 standard. Max. signal amplitude 1.2 mA_{SS}.

Load

Min. 250 Ω, max. 600 Ω (IG-Ex < 400 Ω)

Max. cable length 1,500 m AWG 24, twisted and shielded (for standard and Zone 2/22 devices).

Max. cable length for Ex devices depends on the safety specifications in the certificates.

Baud rate

1,200 baud
Log. 1 representation: 1,200 Hz
Log. 0 representation: 2,200 Hz

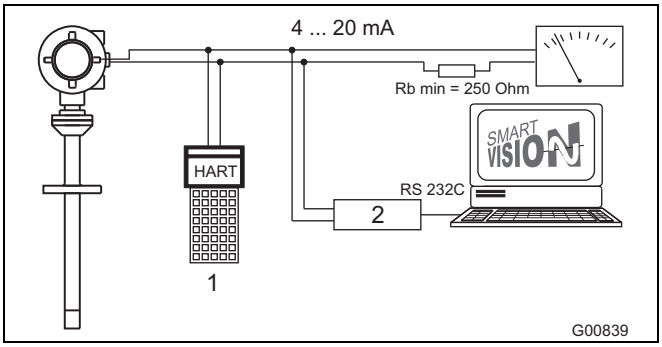


Fig. 4

1 Handheld terminal
2 FSK modem

5.2 PROFIBUS DPV1

With the Sensyflow FMT500-IG thermal mass flowmeter plus PROFIBUS interface, bus communication is based on the "Profile For Process Control Devices" Version 3.0 (PA Profile 3.0) of October 1999. PROFIBUS DP (RS 485 transmission) is used for the bus interface and the acyclic PROFIBUS DPV1 services are supported.

PROFIBUS interface parameters

- DPV1 communication without alarms
- Master C1 and C2 support
- Max. transmission rate: 1.5 Mbaud
- ID number: 0x05CA
- GSD file name: ABB_05CA.GSD

The cables for the PROFIBUS connection must meet the following parameters in accordance with PROFIBUS specification EN 50170 part 8-2:

Parameter	DP, cable type A, shielded
Surge impedance in Ω	135 ... 165 at a frequency of 3 ... 20 MHz
Effective capacitance	(pF/m) 30
Loop resistance (Ω/km)	≤ 110
Solid conductor	AWG 22/1
Flexible conductor	> 0.32 mm^2

As with the analog / HART version, you can parameterize the device using the DSV401 (SMART VISION) software and FMT500-IG PROFIBUS DTM.

Direct connection to intrinsically safe PROFIBUS DP lines is permitted, provided you use approved models and comply with safety-related parameters in accordance with certificates (see figure). The line length and number of bus nodes depend on the Ex barrier used.

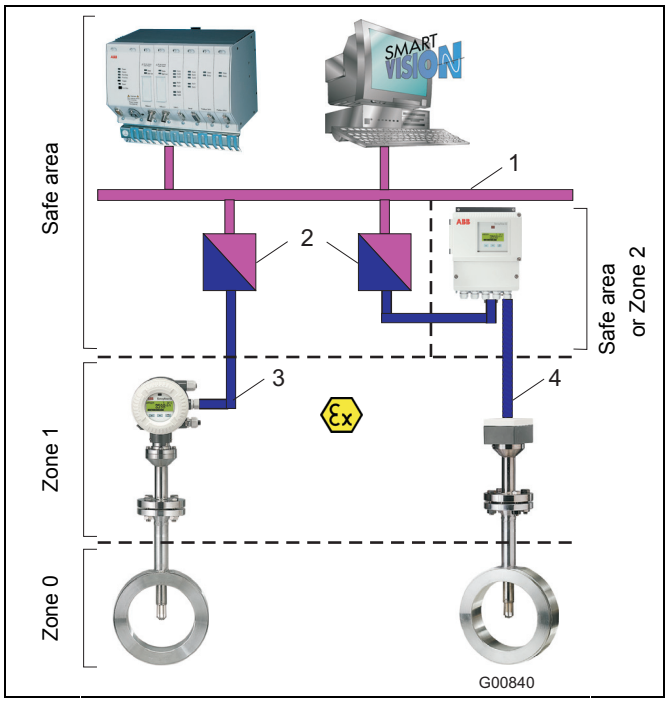
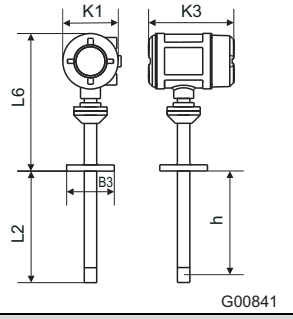


Fig. 5

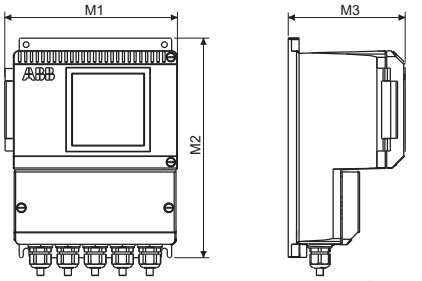
1 PROFIBUS DPV1 non-intrinsically safe
2 Ex barrier PROFIBUS DP (RS 485_IS interface)
3 PROFIBUS DP intrinsically safe
4 Intrinsically safe circuit

6 Dimensions

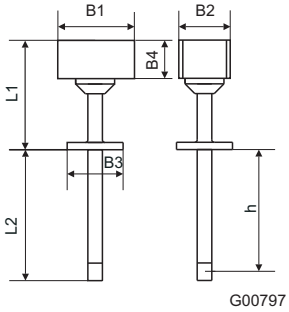
Flowmeter sensor (Integral mount design)



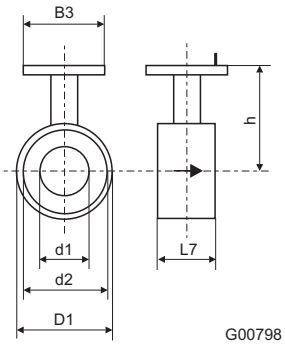
Transmitter (Remote design)



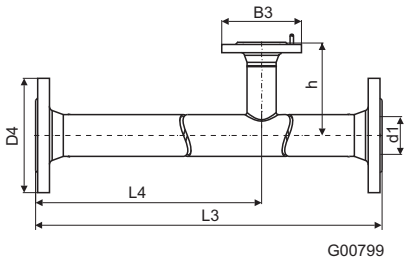
Flowmeter sensor (Remote design)



Pipe component design 1: Wafer flange

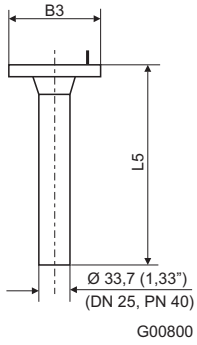


Pipe component design 2: Partial measuring section



optional with integrated flow straightener

Weld-on adapter up to DN 100 (4“)



EN 1092-1 Form B1, PN 40										
Nominal diameter			L2	h	D1	d1	d2	D4	L3	L4
DN 25	B1 = 125	(4.92)	269 (10.59)	263 (10.35)	-	28.5 (1.12)	-	115 (4.53)	600 (23.62)	486 (19.13)
DN 40	B2 = 80	(3.15)			94 (3.70)	43.1 (1.70)	88 (3.46)	150 (5.91)	860 (33.86)	731 (28.78)
DN 50	B3 = Ø115	(4.53)			109 (4.29)	54.5 (2.15)	102 (4.02)	165 (6.50)	1000 (39.37)	837 (32.95)
DN 65	B4 = 58	(2.28)			129 (5.08)	70.3 (2.77)	122 (4.80)	185 (7.28)	1400 (55.12)	1190 (46.85)
DN 80	K1 = 150	(5.91)			144 (5.67)	82.5 (3.25)	138 (5.43)	200 (7.87)	1700 (66.93)	1450 (57.09)
DN 100	K3 = 206	(8.11)			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	L6 = 310	(12.20)			293 (11.54)	206.5 (8.13)	285 (11.22)	-	-	-
> 350	L7 = 65	(2.56)	431 (16.97)	425 (16.73)						
> 700	M1 = 208	(8.19)	781 (30.75)	775 (30.51)						
	M2 = 265	(10.43)								
	M3 = 139	(5.47)								
ASME B 16.5, Cl. 150 (ANSI), Sch 40 S										
1“	B1= 125	4.92)	269 (10.59)	263 (10.35)	-	26.6 (1.05)	-	108 (4.25)	560 (22.05)	454 (17.87)
1 1/2“	B2 = 80	(3.15)			85 (3.35)	40.9 (1.61)	73 (2.87)	127 (5.00)	864 (34.02)	741 (29.17)
2“	B3 = Ø115	(4.53)			103 (4.06)	52.6 (2.07)	92 (3.62)	154 (6.06)	1003 (39.49)	846 (33.31)
3“	B4 = 58	(2.28)			135 (5.31)	78.0 (3.07)	127 (5.00)	-	-	-
4“	K1 = 150	(5.91)			173 (6.81)	102.4 (4.03)	157 (6.18)	-	-	-
6“	K3 = 206	(8.11)			221 (8.70)	154.2 (6.07)	216 (8.50)	-	-	-
8“	L1 = 188	(7.40)			278 (10.94)	202.7 (7.98)	270 (10.63)	-	-	-
> 14“	L5 = 450	(17.72)	431 (16.97)	425 (16.73)						
> 28“	L6 = 310	(12.20)	781 (30.75)	775 (30.51)						
	L7 = 65	(2.56)								
	M1 = 208	(8.19)								
	M2 = 265	(10.43)								
	M3 = 139	(5.47)								

Dimensions in mm (inch)

ASME B 16.5, Cl. 300 (ANSI), Sch 40 S										
1“	B1= 125	(4.92)	269 (10.59)	263 (10.35)	-	26.6 (1.05)	-	123.9 (4.88)	560 (22.05)	454 (17.87)
1 1/2“	B2 = 80	(3.15)			94 (3.70)	40.9 (1.61)	73 (2.87)	155.4 (6.12)	864 (34.02)	741 (29.17)
2“	B3 = Ø115	(4.53)			110 (4.33)	52.6 (2.07)	92 (3.62)	165.1 (6.50)	1003 (39.49)	846 (33.31)
3“	B4 = 58	(2.28)			148 (5.83)	78.0 (3.07)	127 (5.00)	-	-	-
4“	K1 = 150	(5.91)			180 (7.09)	102.4 (4.03)	157 (6.18)	-	-	-
6“	K3 = 206	(8.11)			249 (9.80)	154.2 (6.07)	216 (8.50)	-	-	-
8“	L1 = 188	(7.40)			307 (12.09)	202.7 (7.98)	270 (10.63)	-	-	-
> 14“	L5 = 450	(17.72)	431 (16.97)	425 (16.73)						
> 28“	L6 = 310	(12.20)	781 (30.75)	775 (30.51)						
	L7 = 65	(2.56)								
	M1 = 208	(8.19)								
	M2 = 265	(10.43)								
	M3 = 139	(5.47)								

Dimensions in mm (inch)

7 Installation instructions

7.1 Weld-on adapter for Sensyflow FMT500-IG

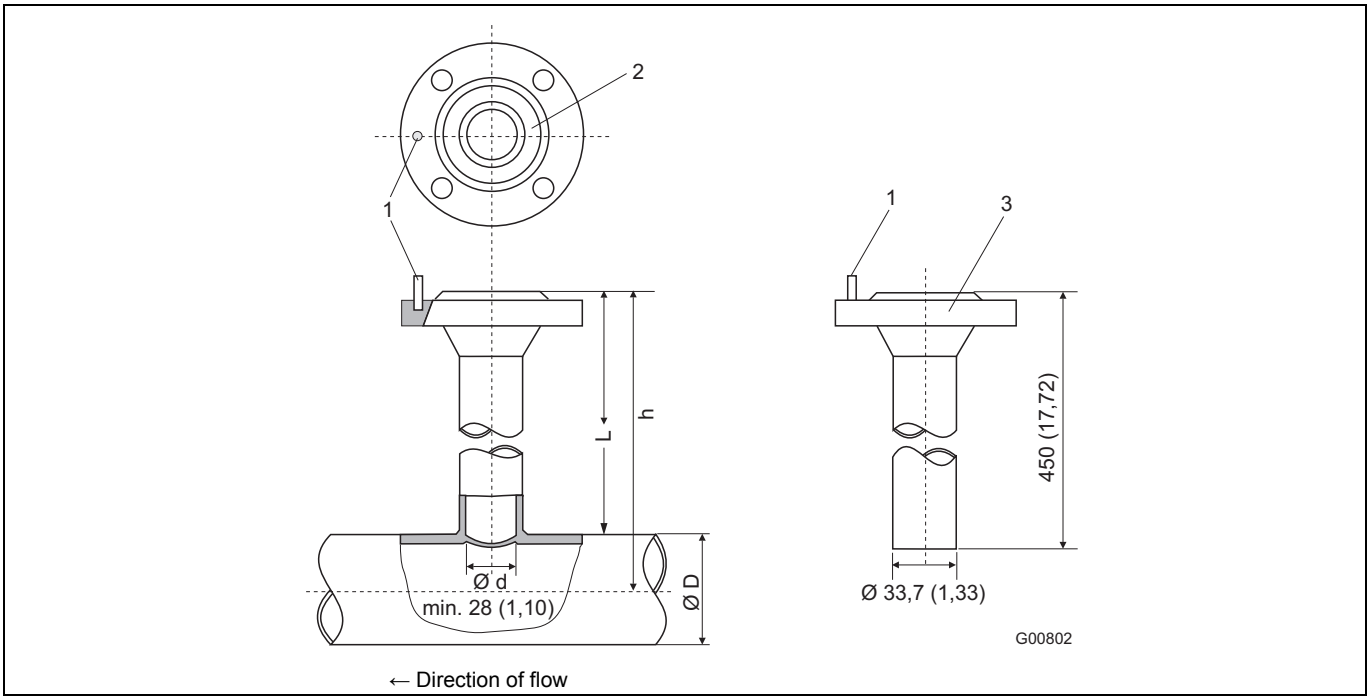


Fig. 6: Dimensions in mm (inch)

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 centrically 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: $L = h - 1/2\ D_{outer}$.

The distance h between the upper flange edge and the pipe center line must be within a tolerance of ± 2 mm (0,08“).

The right angle to the pipe center line must be observed (max. tolerance ± 2°).

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

7.2 Weld-on adapter with ball valve for Sensyflow FMT500-IG

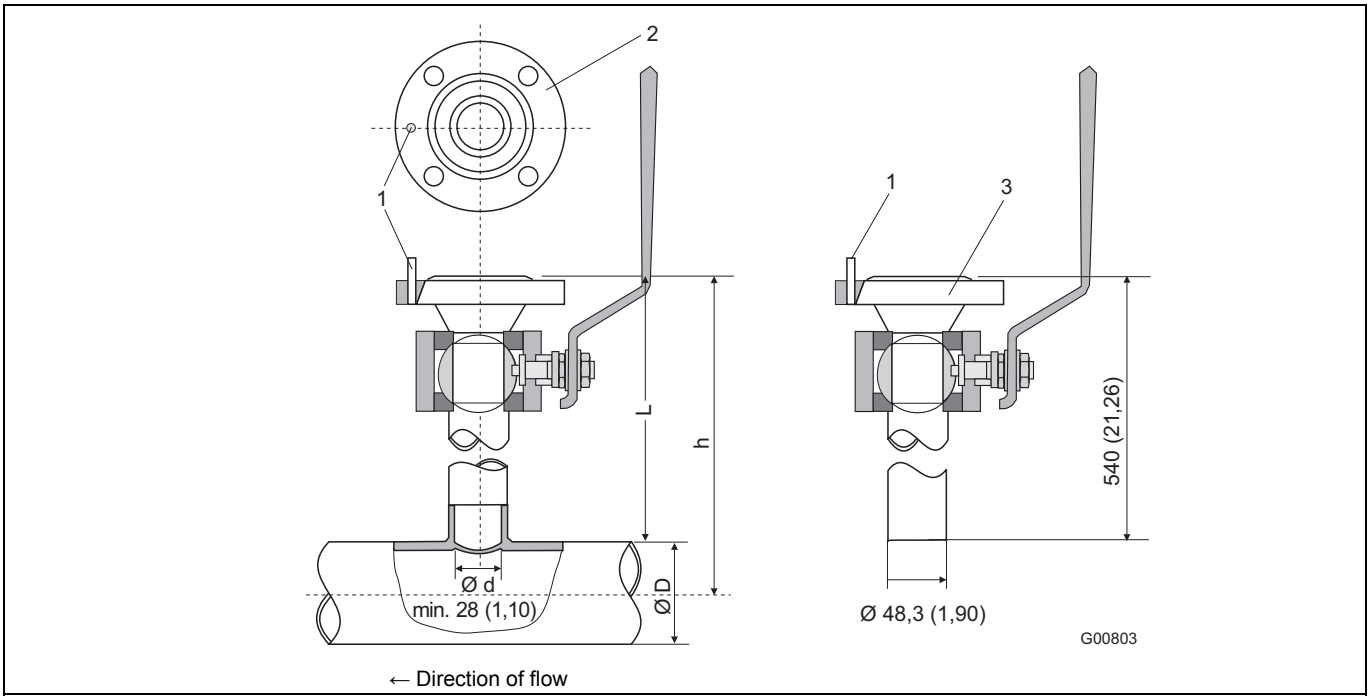


Fig. 7: Dimensions in mm (inch)

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 centrically 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_{outer}.

The distance h between the upper flange edge and the pipe center line must be within a tolerance of ± 2 mm (0,08").

The right angle to the pipe center line must be observed (max. tolerance ± 2°).

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

7.3 Integrated hot tap fitting for Sensyflow FMT500-IG

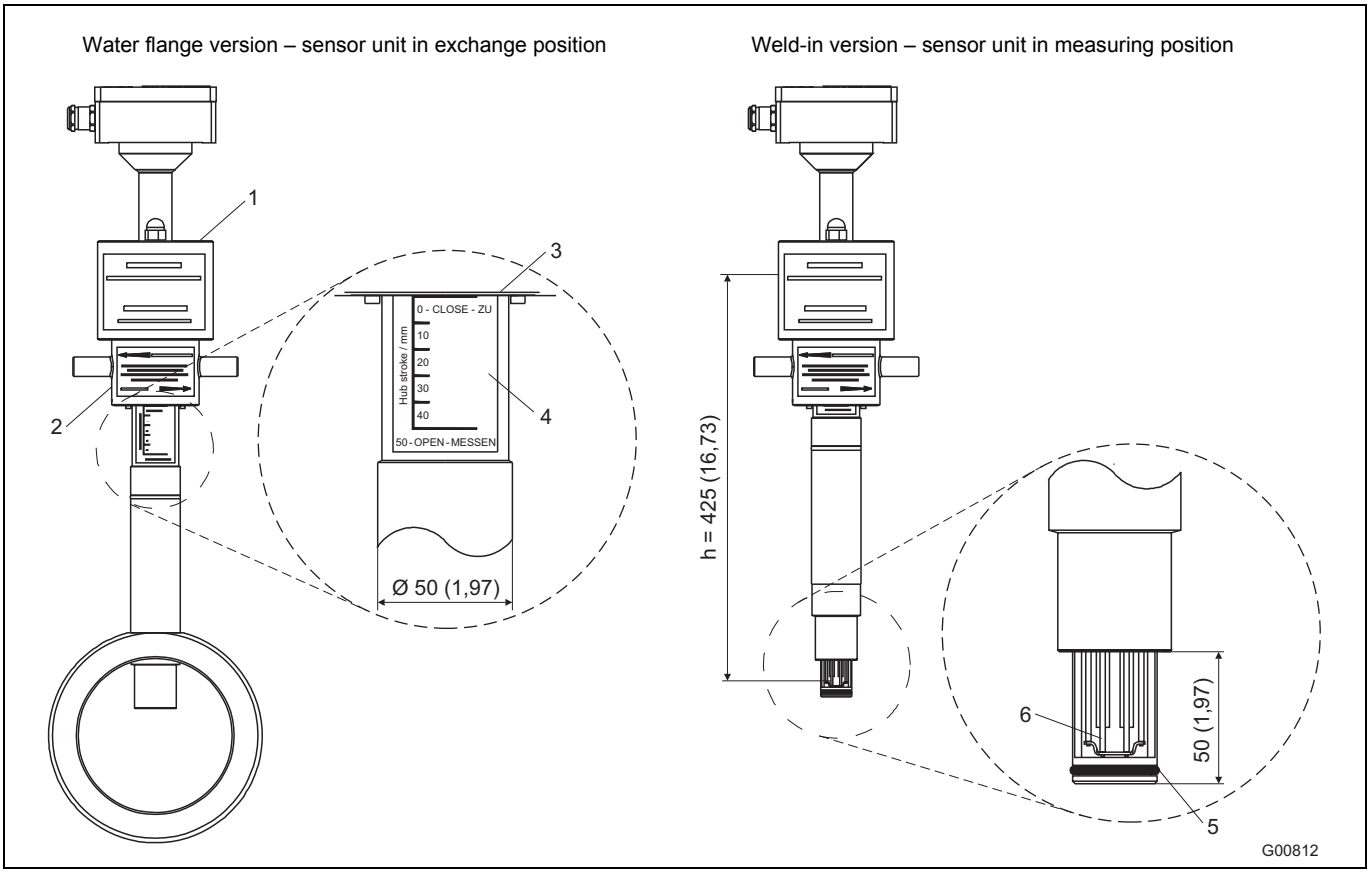


Fig. 8: Dimensions in mm (inch)

1 Covers for DN 25 flange
2 Spigot nur
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.

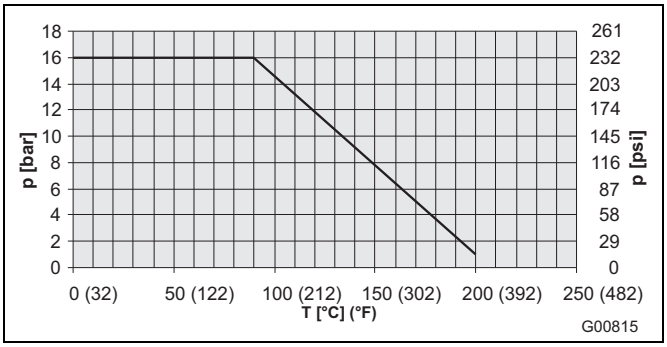


Fig. 9: Maximum pressure/temperature values for the integrated hot tap fitting

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.

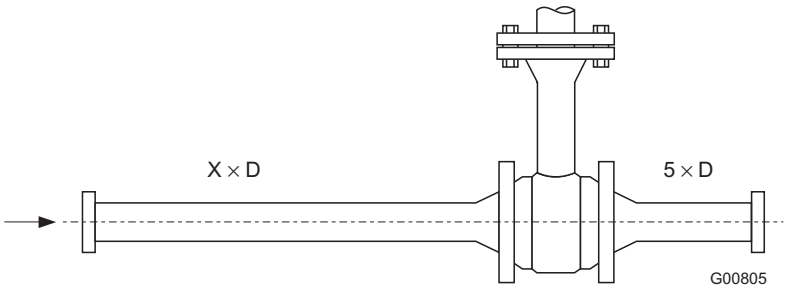
Handling:

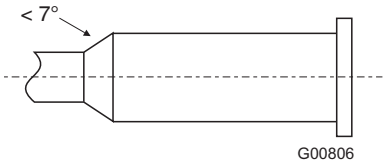
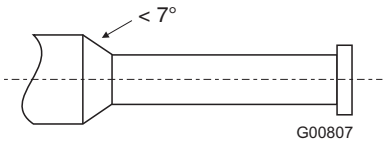
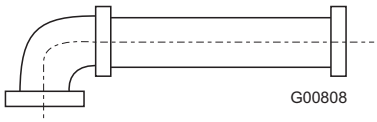
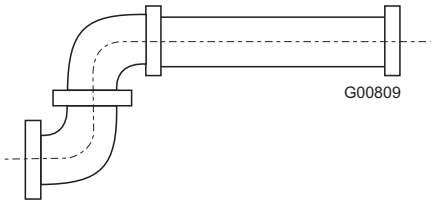
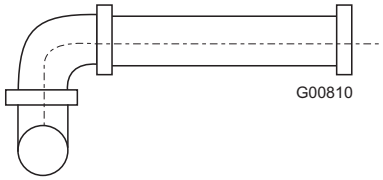
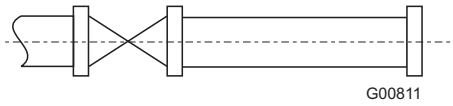
The flowmeter sensor is screwed to the hot tap fitting through the DN 25 flange. Then the cover is put on. The sensor unit is set from the exchange position to the measuring position by turning the spigot nut. The bottom edge of the spigot nut indicates the current sensor unit position (see Detail A, 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.

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.

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



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

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 x 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.

9 Ordering information

		Main Code										Add. Code
Variant digit No. 1 - 6		7	8	9	10	11	12	13	14	15	16	
Sensyflow FMT500-IG Thermal Mass Flowmeter, for Gases, Intelligent	**V14224**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**XXX**
Version												
Standard, -25 ... 150 °C (-13 ... 302 °F)		**1**										
High temperature version, -25 ... 300 °C (-13 ... 572 °F)		2										
ATEX version for Zone 2 / 22, -20 ... 150 °C (-4 ... 302 °F)	5)	3										
ATEX version for Zone 1 / 21, -20 ... 150 °C (-4 ... 302 °F)	6)	4										
ATEX version for Zone 0 / 21, -20 ... 80 °C (-4 ...176 °F)		5										
FM / CSA version Cl. 1 Div 2, -20 ... 150 °C (-4 ... 302 °F) (remote version only)		6										
FM / CSA version Cl. 1 Div 1 / 2, -20...150 °C (-4...302 °F) (compact version only)		7										
GOST Russia - metrological appr. and Ex Zone 1/21, -20...150 °C (-4...302 °F)		A										
GOST Russia - metrological appr. and Ex Zone 0/21, -20...80 °C (-4...176 °F)		B										
Measuring Medium												
Gases, gas mixtures and natural gas (with max. 23.5 Vol% O2 each)			**A**									
Oxygen / gas mixtures > 23.5 Vol% O2, oil and grease-free, with O2 certificate (max. 150 °C / 302 °F)			B									
Natural gas, with DVGW certificate (max. 80 °C / 176 °F)			C									
Hydrogen, Helium (max. 8 bar / 0.8 MPa / 116 psi, always with process gas calibration)	7)		D									
Sensor Unit												
Ceramic sensor				**1**								
Mounting Length / Material												
263 mm (10.4 in.) / AISI 316Ti SST (1.4571) (DN 25 ... DN 350 [1 ... 14 in.])				1)	**1**							
425 mm (17 in.) / AISI 316Ti SST (1.4571) (> DN 350 ... DN 700 [> 14 ... 28 in.])				1)	2							
775 mm (31 in.) / AISI 316Ti SST (1.4571) (> DN 700 [> 28 in.])				1)	3							
Power Supply												
Universal power supply 110 ... 230 V AC / DC					2)	**1**						
Low voltage power supply 24 V AC / DC					8)	2						
Design												
Compact design with display, controlled via magnetic pen and keypad							**1**					
Remote design with display, controlled via magnetic pen and keypad (for required cable see accessories)						9)	2					
Communication												
Analog signal / HART 4 ... 20 mA, alarm < 3.5 mA								**1**				
Analog signal / HART 4 ... 20 mA, alarm > 22 mA								4				
Analog signal / HART 0 ... 20 mA								5				
PROFIBUS DPV1, direct connection of bus cable								2				
PROFIBUS DPV1, with DP M12 connector socket							3)	3				
Cable Glands												
M20 x 1.5									**1**			
1/2 in. NPT									2			
Number of Characteristic Curves												
1 characteristic curve										**1**		
2 characteristic curve										2		
3 characteristic curve										3		
4 characteristic curve										4		
Certificates: Calibration												
Factory certificate											**0**	
DKD certificate of calibration with air (not for process gas calibration)										4)	1	

Continued next page

		Main Code										Add. Code
Variant digit No.	1 - 6	7	8	9	10	11	12	13	14	15	16	
Sensyflow FMT500-IG Thermal Mass Flowmeter, for Gases, Intelligent	**V14224**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**XXX**

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, SIL	
GOST Russia - metrological approval	CG1
GOST Kazakhstan - metrological approval	CG2
SIL 1 - Declaration of conformity	CS1
Language of Documentation	
German	M1
French	M4
English	M5
Polish	M9
Russian	MB

Accessories	**Code**
FMT500-IG Special cable between transducer and evaluation unit, Cable length 5 m	7962844
FMT500-IG Special cable between transducer and evaluation unit, Cable length 15 m	7962845
FMT500-IG Special cable between transducer and evaluation unit, Cable length 25 m	7962846
FMT500-IG PROFIBUS DP-T connector plug	7962847
FMT500-IG PROFIBUS DP socket, for customizing the bus cable	7962848
FMT500-IG PROFIBUS DP connector, for customizing the bus cable	7962849

1) Nominal size ranges when using pipe components or weld-on adapters without ball valve
2) +/- 10 % (f = 48 ... 62 Hz)
3) For non-Ex / compact versions only
4) PTB approved DKD calibration facility No. 05701
5) Manufacturer's declaration
6) The max. allowed gas temperature / process temperature depends on the temperature class: T1 / T2 max. 150 °C (302 °F), T3 / T4 max. 100 °C (212 °F)
7) 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
8) +/- 20 % (f = 48 ... 62 Hz)
9) With ATEX versions: wall housing with operating electronics, can be mounted in Ex zone 2

		Main Code						Add. Code
Variant digit No.	1 - 6	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% O2)		**A**						
Oxygen/gas mixtures > 23.5 Vol% O2, oil and grease-free, with O2 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 straigtheners			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

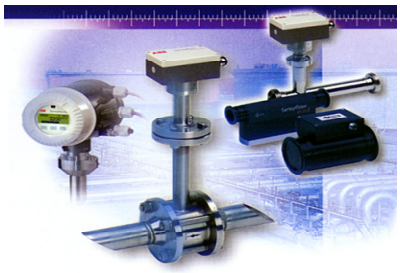
9.1 Additional ordering information

FMT500-IG		
Gas component 1	Vol. %	(clear text, for max. 4 characteristics)
Gas component 2	Vol. %	(clear text, for max. 4 characteristics)
Gas component 3	Vol. %	(clear text, for max. 4 characteristics)
Gas component 4	Vol. %	(clear text, for max. 4 characteristics)
Gas component 5	Vol. %	(clear text, for max. 4 characteristics)
Gas component 6	Vol. %	(clear text, for max. 4 characteristics)
Gas component 7	Vol. %	(clear text, for max. 4 characteristics)
Gas component 8	Vol. %	(clear text, for max. 4 characteristics)
Gas component 9	Vol. %	(clear text, for max. 4 characteristics)
Gas component 10	Vol. %	(clear text, for max. 4 characteristics)
		Summe 100 %
Operating temperature		(clear text, for max. 4 characteristics)
Operating pressure		(clear text, for max. 4 characteristics)
Nominal size, Pipe inner diameter		(clear text, for max. 4 characteristics)
Measuring range		(clear text, for max. 4 characteristics)
Unit[1)]		(clear text, for max. 4 characteristics)
Standard conditions (e. g. 0 °C, 1013 mbar)		(clear text, for max. 4 characteristics)
Display and menu language (delivered state)		German, English, French, Portuguese
Material of the connected pipes		

1) Available flow rate units:

t/d	t/h	t/min	t/s
kg/d	kg/h	kg/min	kg/s
	g/h	g/min	g/s
lb/d	lb/h	lb/min	lb/s
Nm^3/d	Nm^3/h	Nm^3/min	Nm^3/s
NL/d	Nl/h	Nl/min	Nl/s
SCFD	SCFH	SCFN	SCFS

10 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

Type of gas (no mixtures): _____
Operating pressure (bar abs.)
Min./norm./max., approx. _____
Operating temperature (°C)
Min./norm./max., approx. _____

Mixed gas, gas composition in vol.%[1)]

Component 1/name/vol.%: _____
Component 2/name/vol.%: _____
Component 3/name/vol.%: _____
Component 4/name/vol.%: _____
Component 5/name/vol.%: _____

Flowrate [2)] Min.: ____ Norm.: _____ Max.: _____

Flow unit:

Standard volume

Nm³/h ☐
Nm³/min ☐
Nl/min ☐
SCFM ☐
Other _____

Mass flow units

kg/h ☐
kg/min ☐
g/min ☐
t/h ☐
Other _____

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

Pipeline/pipe component[3)]

DN/PN: _____
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 ☐
FMT400-VTS ☐
FMT400-VTCS ☐
FMT700-P[4)] ☐
FMT200-ECO2 ☐
FMT200-D ☐

Design:

Integral mount design ☐
Remote design with
Cable length 5 m ☐
Cable length 15 m ☐
Cable length 25 m ☐

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 ☐
GOST ☐
FM/CSA ☐

24 V ☐
110 V ☐
230 V ☐

Comments:

1) Please specify the composition of mixed gases
(e.g., North Sea natural gas: 1) CH_4 90%, 2) C_2H_6 5%, 3) N_2 3%, 4) C_3H_8, 1%, 5) CO_2 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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