Data Sheet
10/14-6.41 EN

Thermal Mass Flowmeter FMT500-IG (Sensyflow iG)

for gases, intelligent

- **Direct measurement of mass flow and gas temperature**
  - No additional pressure and temperature compensation required
- **Digital measured value processing with improved signal quality**
- **Wide measuring range up to 1:150 with high measuring accuracy**
  - Factory-calibrated, with (optional) DKD calibration certificate
- **Short response time of less than 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 DN25...DN200 (1''...8'')
  - Weld-on adapters for larger diameters and square ducts
  - Reliable and convenient hot tap fittings
- **Compact device with back-lit display**
- **Remote version with separate wall housing**
- **Communication:**
  - PROFIBUS DPV1 or analog/HART signal
- **Diagnostic and alarm functions**
- **ATEX certificate up to Category 1 (Zone 0), including Categories 2 and 3 and Dust-Ex**

HART® FIELD COMMUNICATIONS PROTOCOL

PROFIBUS

Direct mass flow measurement
Short response time
High accuracy

ABB

Description

FMT500-IG (Sensyflow 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 compact version of the FMT500-IG (Sensyflow iG) metering system comprises a transducer with the complete evaluation electronics and a pipe component. In the remote version the transducer and the electronics wall housing are connected via a max. 25 m long cable. Depending on the version, the transducer 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 to DN 200 and in various designs. It is also possible to install the transducer directly in square ducts or pipes with any diameter via a weld-on adapter.

Measuring principle

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

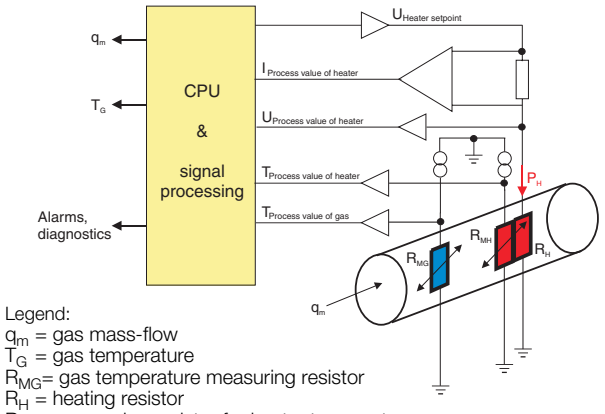
Physics of measurement

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 of 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 now 4 signals available to the evaluation electronics. These include, besides the heating power, the temperatures of the fluid and the heated sensor, 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.

Digital Sensyflow measuring principle



Legend:
q_m = gas mass-flow
T_G = gas temperature
R_{MG}= gas temperature measuring resistor
R_H = heating resistor
R_{MH}= measuring resistor for heater temperature
P_H = heating power

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

Overview of FMT500-IG measuring system

FMT500-IG with display
(Compact version)

FMT500-IG transducer and electronics unit
(Remote version)

Pipe component 1 in wafer flange version
DN 40 to DN 200 / ANSI 1½“ to 8“

Pipe component 2 as partial measuring section
DN 25 to DN 50 / ANSI 1“ to 2“

Weld-on adapter
from DN 150

1) Centering pin on outlet run side

Type overview

Type	FMT500-IG	FMT500-IG (Ex)
Application	Process engineering	
Explosion protection	Manufacturer 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) FM/CSA Version under preparation
Components	– IG transducer as compact or remote version – Pipe component type 1 or 2 or weld-on adapter	
Nominal pipe sizes	– Pipe component type 1: wafer flange DN 40, 50, 80, 100, 150, 200 – ANSI 1½“, 2“, 3“, 4“, 6“, 8“ – Pipe component type 2: measuring section DN 25, 40, 50 – ANSI 1“, 1½“, 2“ (Process connection: flanges according to DIN 2635 Form C, PN 40 resp. ASME B 16.5, Cl. 150/300 (ANSI) – Weld-on adapter for square ducts and pipe diameters ≥150 mm	
Materials	1.4571, ceramic sensor (other materials on request)	
Measured gases	Gases and gas mixtures with known composition	

Equipment and functions

- Graphic display, back-lit, 120 x 32 pixels (optional)
- Mass flow or standard volume flow measurement, digital or bargraph display indication (see p. 15 for available flow rate units)
- 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 adaptation 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

PROFIBUS communication, DPV1 version

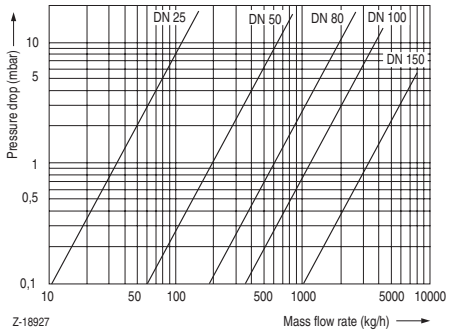
- in acc. with PA profile 3.0, max. transmission rate 1.5 Mbaud, direct connection to an intrinsically safe PROFIBUS DP in the hazardous area is possible

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 alarms
- 2 digital inputs, configurable for/as
  – external change-over of characteristic curve
  – Totalizer start/stop or reset
  – frequency input for external signal transmitter
- 24 V DC output for input/output wiring or for transmitter supply (max. 30 mA , not for explosion-proof versions)

Technical data

Type	**FMT500-IG**	**FMT500-IG (Ex)**
Measuring ranges	q_{min} ... q_{max}	q_{min} ... q_{max}
DN 25	0 (1.5) ... 180	0 (1.5) ... 160
DN 40	0 (3) ... 450	0 (3) ... 430
DN 50	0 (5) ... 750	0 (5) ... 700
DN 80	0 (15) ... 2,000	0 (15) ... 1,700
DN 100	0 (25) ... 3,200	0 (25) ... 3,000
DN 150	0 (60) ... 9,000	0 (60) ... 8,000
DN 200	0 (100) ... 15,000	0 (100) ... 13,000
up to 3000 mm	0 (20,000) ... 3,000,000	0 (20,000) ... 2,700,000
(square ducts and larger diameters on request)	For air or nitrogen in kg/h (other gases on request)	For air or nitrogen in kg/h (other gases on request)
	The above values are guide values for applications involving air under atmospheric conditions	
Measured error	Under calibration conditions in the stated measuring range	
Air, nitrogen	≤ ± 0.9 % of measured value ± 0.05 % of possible end value in this nominal size (s. meas. ranges)	
other gases	≤ ± 1.8 % of measured value ± 0.10 % of possible end value in this nominal size (s. meas. ranges)	
	For special calibration on request	
Repeatability error	< 0.2 % of measured value	
Influence of medium temperature	< 0.05 %/K of measured value (depending on type of gas)	
Influence of medium pressure	typically 0.2 %/100 kPa (/1 bar) of measured value (depending 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
Operating pressure	4×10^6 Pa (40 bar)	
Operating temperature of medium (Transducer)	Standard range: -25...+150 °C Extended range: -25...+300 °C for Zone 2/22 versions: -20...+150°C	acc. to temperature classes of ATEX certificate max. -20...+150 °C
Ambient temperature T_{amb} **Evaluation electronics** **Without display** **With display**	-25...+65 °C -25...+50 °C for Zone 2/22 versions: -20...+50°C	-20...+50 °C -20...+50 °C
	Other ambient temperatures on request	
Storage temperature	-25...+85 °C	
Degree of protection	IP 67 (IP 66 for remote transducer)	
Recommended installation requirements	According to DIN EN ISO 5167-1 Minimum inlet run 15 × pipe diameter D, outlet run 5 × pipe diameter D (see page 15)	
Pressure loss (logarithmic diagram)	< 1.0 kPa (10 mbar), typical value 0.1 kPa (1 mbar)	
Electrical power values	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 dissipation	20 VA, current consumption 800 mA, slow-blow fuse of at least 2 A required	
Connections	M20 x 1.5 or ½“ NPT	
Cable (remote version)	Round signal cable with braided copper screen LIYCY 10 x 0.5 mm^2 Max. 50 m between transducer and electronics unit (max. 25 m for ATEX-zone 2/22 versions with constant power, as well as ATEX zone 1 and 0 versions)	
Output signals		
PROFIBUS DPV1 version	EN 50170, acc. to PA profile 3.0	
Analog/HART version		
Analog output	0/4...20 mA (+ 10 % overrange), load < 600 Ω electrically isolated	
Digital outputs	2 x passive optocoupler (approx. 100 mA) selectable as frequency, pulse, or contact output	
Digital inputs	2 x 24 V lin typ. 10 mA (low < 2 mA, high > 10 mA) frequency and contact input	
Installation class	Overvoltage category III, degree of pollution 2	

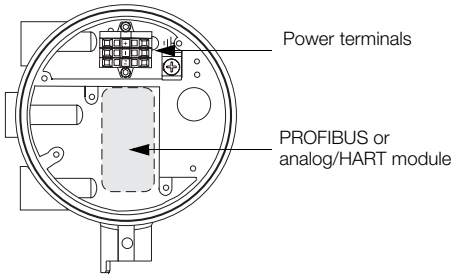


Electrical connection of standard and Zone 2/22 versions

Connection area of compact version

L / + Phase / + terminal
N / - Neutral / - terminal
PE Protective earthing

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

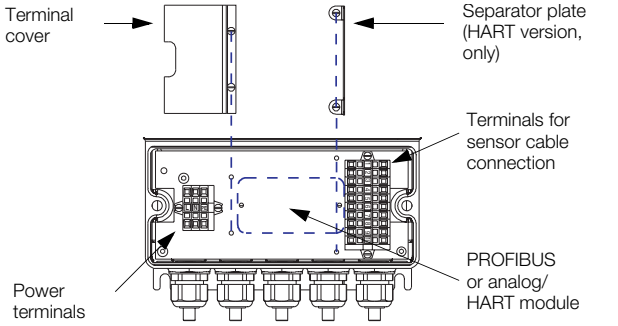


Connection area of remote version

L / + Phase / + terminal
N / - Neutral / - terminal
PE Protective earthing

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

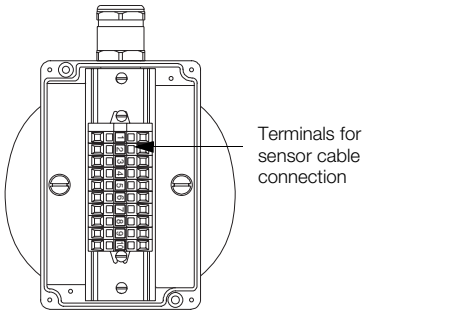
1:1 cable link from the terminal block in the remote housing to the sensor.



Sensor connector housing

Sensor	PIN1...PIN10
Cable	at least 9-wire
Min. size	0.5 mm
Max. cable length	50 m (25 m max. for zone 2/22 version with constant power)

1:1 cable link on remote housing
(PIN6 not used)

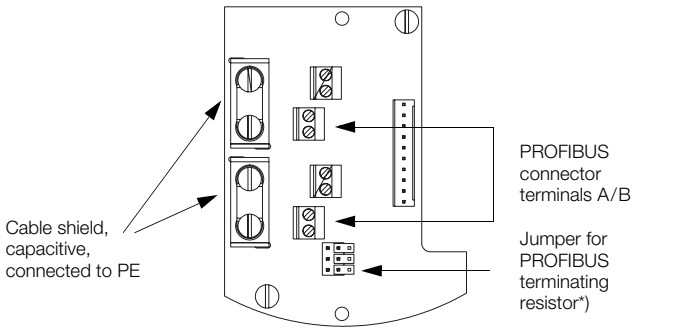


PROFIBUS module connection

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

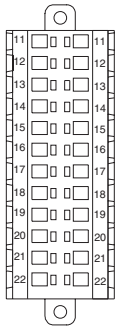
*) **Annotation on terminating resistors:**
The bus termination should only be activated by setting the respective jumpers if the device is the only bus station on this PROFIBUS branch.

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.



Analog/HART module connection

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

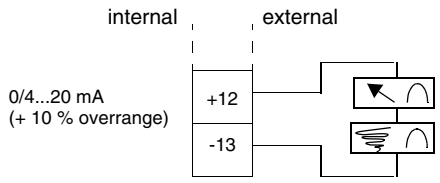


Zone 2/22 versions: codes and temperature limits

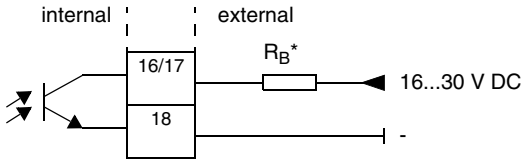
Remote housing	Remote sensor	Compact version
II 3G EEx nA II T4 **II 3D IP 67 T 115 °C**	**II 3G EEx nA II T4** **II 3D IP 66 T 150 °C**	**II 3G EEx nA II T4** **II 3D IP 67 T 150 °C**
T_{amb} = -20...+50 °C	T_{amb} = -20...+80 °C T_{medium} = -20...+150 °C	T_{amb} = -20...+50 °C T_{medium} = -20...+150 °C

Examples for connecting peripherals (analog/HART version)

Active direct current output



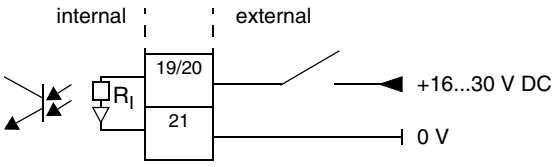
Passive digital outputs, optocouplers



Can be used as frequency, pulse or contact outputs

*) $R_B \leq U_{ce}/I_{ce}$

Digital inputs



PROFIBUS DPV1 version with DP M12 connector socket

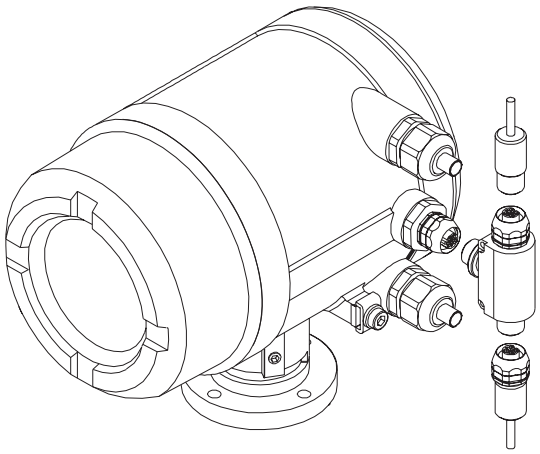
This version with PROFIBUS DP M12 connector socket allows disconnection of the device from the bus without interrupting PROFIBUS DP operation. Instead of the center cable gland an assembled and wired DP M12 connector socket is supplied.

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

Protection type of the plug-in connections: IP 66

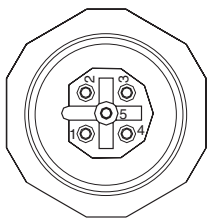
This device variant is only available for non-Ex compact versions.

Please refer to Data Sheet 10/63-6.44 EN for other versions of T-pieces and appropriate DP connector plugs.



Pin assignment of the device

1	+ 5 V
2	PROFIBUS DPV1 line A (green)
3	GND
4	PROFIBUS DPV1 line B (red)
5	Cable shield /protective earth



DP M12 connector socket

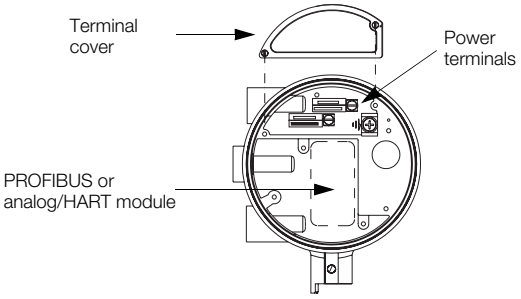
Electrical connection of ATEX versions for Category 1/2 G and 2 D (Zone 0/1/21)

Connection area of compact version

L / + Phase/+ terminal
N / - Neutral/- terminal
PA Protective earthing

Universal power supply unit 110...230 V AC/DC ± 10 %, 20 VA 48...62 Hz
or
low-voltage power supply unit 24 V AC/DC ± 20 %, 20 VA 48...62 Hz

Explosion protection for power terminals: EEx e

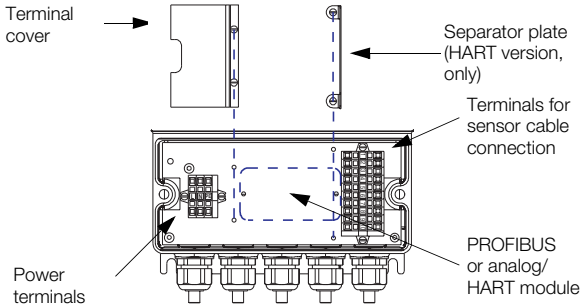


Connection area of remote version

L / + Phase/+ terminal
N / - Neutral/- terminal
PE Protective earthing

Universal power supply unit 110...230 V AC/DC ± 10 %, 20 VA 48...62 Hz
or
low-voltage power supply unit 24 V AC/DC ± 20 %, 20 VA 48...62 Hz

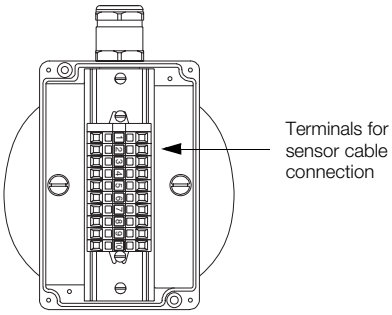
1:1 cable link from the terminal block in the remote housing to the sensor.



Sensor connector housing

Explosion protection	EEx ia
Sensor	PIN1...PIN10
Cable	at least 9 wires
Min. size	0.5 mm
Max.cable length	25 m

1:1 cable link on remote housing
(PIN6 not used)



PROFIBUS module connection

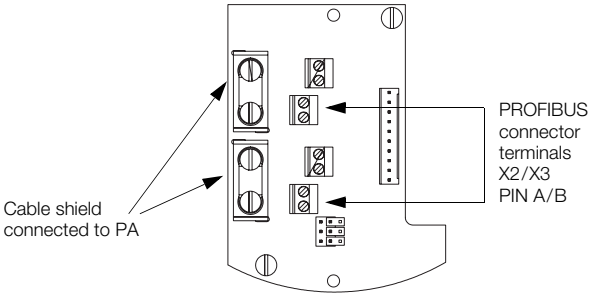
A PROFIBUS DPV1 in/out signal
B PROFIBUS DPV1 in/out signal

Type of explosion protection EEx ib

May be connected to an intrinsically safe PROFIBUS DP, only.

Exernal bus termination in acc. with RS 485_IS specification.

When connecting the fieldbus or signal cables observe the safety-related specifications in the KEMA 03ATEX2100 certificate.

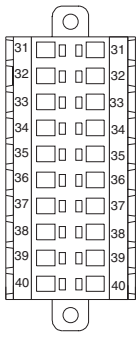


Analog/HART module connection

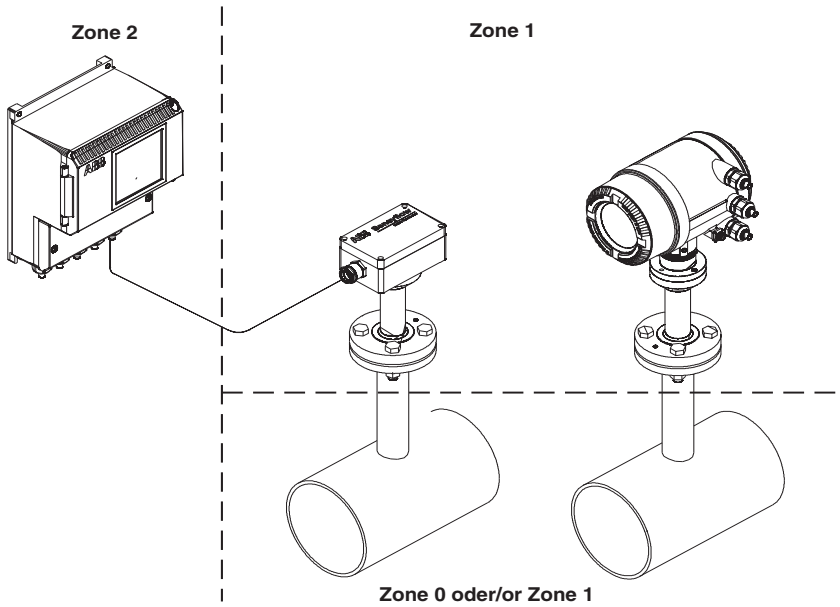
31 + I_{out} analog output / HART
32 - I_{out} analog output / HART
33 D_{out} 1
34 GND_{out} (ground D_{out} 1)
35 D_{out} 2
36 GND_{out} (ground D_{out} 2)
37 D_{in} 1
38 GND_{in} (ground D_{in} 1)
39 D_{in} 2
40 GND_{in} (ground D_{in} 2)

Type of explosion protection EEx ib or EEx e

When connecting the fieldbus or signal cables observe the safety-related specifications in the KEMA 03ATEX2100 certificate.



Mounting in hazardous areas



Remote housing Zone 2/21	**Remote sensor** Housing Zone 1, sensor Zone 0	**Compact version** Housing Zone 1, sensor Zone 0
II 3(1) G EEx nA [ia] [ib] IIC T4 **II 2 D T 115 °C**	**II 1/2 G EEx ia IIC T4** **II 2 D T 80 °C**	**II 1/2 G EEx de [ia] [ib] IIC T4** **II 2 D T 115 °C**
T_{amb} = -20...+50 °C	Housing and sensor Zone 1	Housing and sensor Zone 1
Optionally -40 °C for ambient temperature	**II 2 G EEx ia IIC T4...T1** **II 2 D T 100 °C or 200 °C or 300 °C**	**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...+80 °C	T_{amb} = -20...+50 °C
	Optionally -40 °C for ambient temperature	Optionally -40 °C for ambient temperature

FMT500-IG (Sensyflow iG-Ex) compact version				
Gas	Surface temperature	Process temperature	Sensor	Electronics unit
T4	T 115 °C	-20...+ 80 °C	1G	2G, 2D
T4	T 115 °C	-20...+100 °C	2G	2G, 2D
T3	T 115 °C	-20...+100 °C	2G	2G, 2D
T2	T 200 °C[1)]	-20...+200 °C[1)]	2G	2G, 2D
T1	T 300 °C[1)]	-20...+300 °C[1)]	2G	2G, 2D
FMT500-IG (Sensyflow iG-Ex) remote housing				
Gas	Surface temperature		Electronics unit	
T4	T115 °C		3G, 2D	
FMT500-IG (Sensyflow iG-Ex) remote sensor				
Gas	Surface temperature	Process temperature	Sensor	Connection head
T4	T 80 °C	-20...+ 80 °C	1G	2G, 2D
T4	T 80 °C	-20...+100 °C	2G	2G, 2D
T3	T 100 °C	-20...+100 °C	2G	2G, 2D
T2	T 200 °C[1)]	-20...+200 °C[1)]	2G	2G, 2D
T1	T 300 °C[1)]	-20...+300 °C[1)]	2G	2G, 2D

[1)] Temperatures in accordance with ATEX temperature classes, max. process temperature for transducer -20...+150 °C

Safety-related input and output specifications

PROFIBUS DPV1 version

Output current circuit				
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'[µH/Ω]
PIN A/B	± 155	± 144.2	≤ 250	≤ 28.5
	Minimum cable size 0.2 mm Max. input voltage U_i: ± 4.20 V Max. input current I_i: ± 2.66 A (Value for RS 485_IS interface in accordance with KEMA Ex certificate) Electrical isolation of the RS 485_IS PROFIBUS fieldbus signals A and B Cable shield is connected to PA			

Analog/HART version

Output current circuit	Intrinsically safe EEx ib IIC/IIB				Not intrinsically safe Um = 60 V
Current output Active PIN 31 + 32	U_o = 17.2 V;	U_i = 30 V;	I_{ii} = 100 mA		U_B = 30 V I_B = 30 mA
	I_o	P_o	EEx ib IIC		
	[mA]	[mW]	C_i[nF]	L_i[mH]	
	78.3	337	2.0	0.25	
	Characteristic curve: linear Approved for connection to passive intrinsically safe current circuits, only PIN 32 is connected to PA				
Digital output Passive D_{out}1: PIN 33 + 34 D_{out}2: PIN 35 + 36	U_I = 15 V I_I = 30 mA P_I = 115 mW		C_I = 2.0 nF L_I = 0.250 mH		U_B = 30 V I_B = 100 mA
Digital input Passive D_{in}1: PIN 37 + 38 D_{in}2: PIN 39 + 40	U_I = 30 V I_I = 250 mA P_I = 1.1 W		C_I = 2.0 nF L_I = 0.250 mH		U_B = 30 V I_B = 100 mA

Special requirements:

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

The rated voltage of not intrinsically safe current circuits is U_m = 60 V.

- 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; not intrinsically safe = black.
- The transducer 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 measured medium.

Notice:
The values indicated here have been taken out of the approval certificate. Always observe the specifications and supplements in the ATEX certificate.

Do not open the front cover of the housing in the hazardous area!

Always observe the safety specifications in the operating instruction for all device versions!

Communication

HART

The HART protocol is used for digital communication between a process control system/PC, a hand-held terminal and a field instrument. All parameters related to the device or measuring point can be transferred from the transmitter to the process control system or PC. Also, the transmitter can be re-configured in this way.

Digital communication is realized by modulating an AC signal upon the analog output (4...20 mA). This signal does not affect the connected evaluation units.

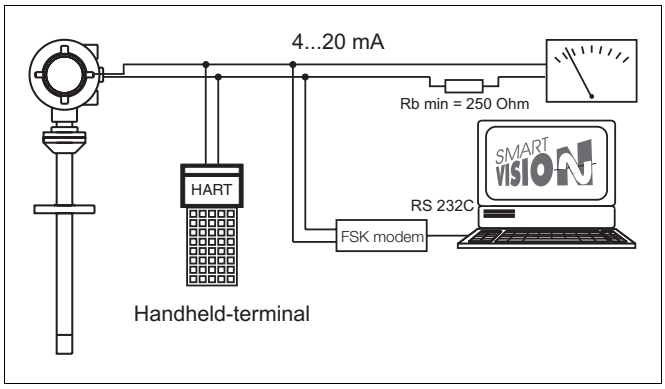
DSV4xx (SMART VISION) - a universal communication program for intelligent field instruments using the FDT/DTM technology - is the appropriate operation and configuration tool. Various communication methods allow for data exchange with the entire range of field instruments. This program is mainly designed for parameter display, configuration, diagnostics and data management of all intelligent field instruments meeting the communication requirements.

Basic features like the upper range value or some flow rate units can be configured by using the universal HART DTM. The full functionality will be available with the FMT500-IG HART DTM (under preparation).

Transmission method
FSK modulation on the 4...20 mA current output (+ overrange) acc. to Bell 202 Standard. Max. signal amplitude 1.2 mA_{PP}.

Load
Min. 250 Ω, max. 600 Ω
Max. cable length 1500 m AWG 24, twisted, shielded

Baud rate
1200 bauds
Indication of logical1: 1200 Hz
Indication of logical 0: 2200 Hz



PROFIBUS DPV1

Bus communication of the thermal gas mass flowmeter FMT500-IG (Sensyflow iG) with PROFIBUS interface is based on the "Profile For Process Control Devices" Version 3.0 (PA Profile 3.0) as of October 1999. PROFIBUS DP (RS 485 type transmission) is used for bus coupling. Acyclic PROFIBUS DPV1 services are supported.

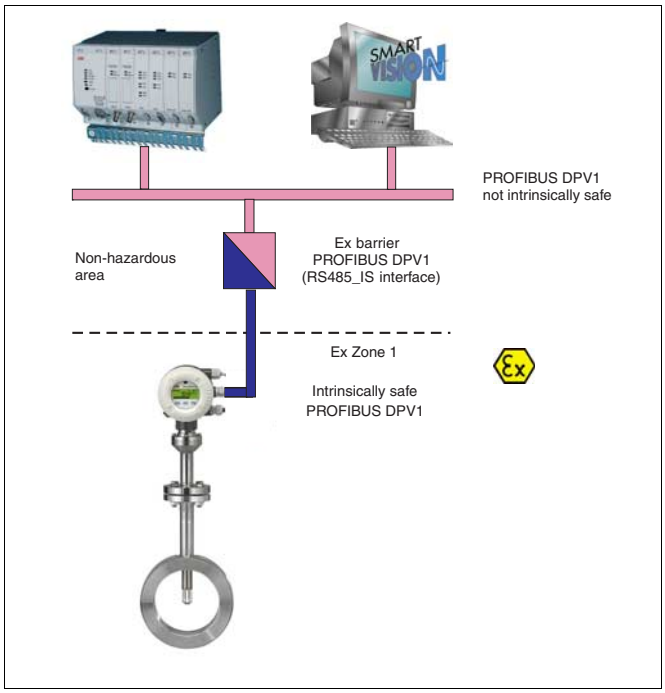
PROFIBUS interface parameters
- DPV1 communication without alarms
- Support of C1 and C2 masters
- Max. transmission rate: 1.5 Mbauds
- ID number: 0x05CA
- GSD file name: ABB_05CA.GSD

The cables for PROFIBUS connection must meet the following requirements to comply with PROFIBUS Specification EN50170 Part 8-2:

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

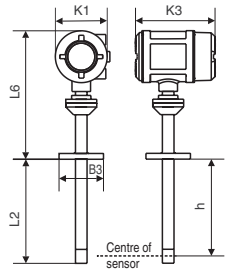
Parameter setting and configuration are possible by using the DSV4xx (SMART VISION) program and the PROFIBUS-DTM FMT500-IG, similar to analog/HART communication.

Direct connection to intrinsically safe PROFIBUS DP lines (see the illustration below) is permissible under the proviso that approved device models are used and the safety specifications and safety-related parameters in accordance with KEMA 03ATEX2100 are observed. The cable length and possible number of Ex bus nodes depend on the Ex barrier used.

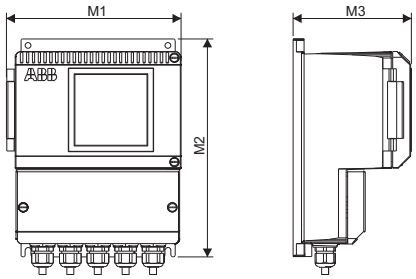


Dimensional drawings (dimensions in mm)

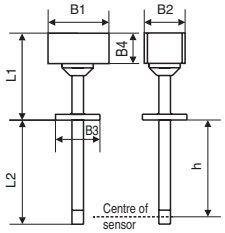
Transducer (compact version)



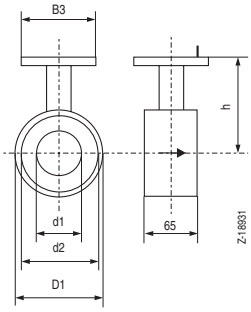
Housing for evaluation electronics (remote version)



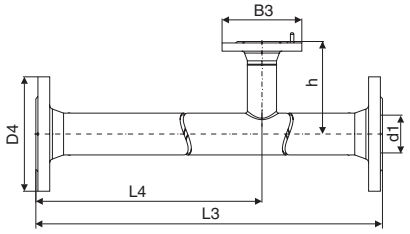
Transducer (remote version)



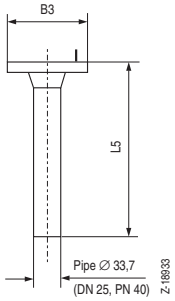
Pipe component 1: Wafer flange



Pipe component 2: Partial measuring section



Weld-on adapter



PN 40

Nom. size		L2	h	D1	d1	d2	D4	L3	L4	L5
DN 25	B1= 125	269	263	–	28.5	–	115	600	486	–
DN 40	B2 = 80			94	43.1	88	150	860	731	–
DN 50	B3 = Ø115			109	54.5	102	165	1000	837	–
DN 80	B4 = 58			144	82.5	138	–	–	–	–
DN 100	K1 = 150			170	107.1	162	–	–	–	–
DN 150	K3 = 206			226	159.3	218	–	–	–	450
DN 200	L1 = 188			293	206.5	285	–	–	–	
> 350	L6 = 310	431	425							
>700	M1 = 208	781	775							
	M2 = 265									
	M3 = 139									

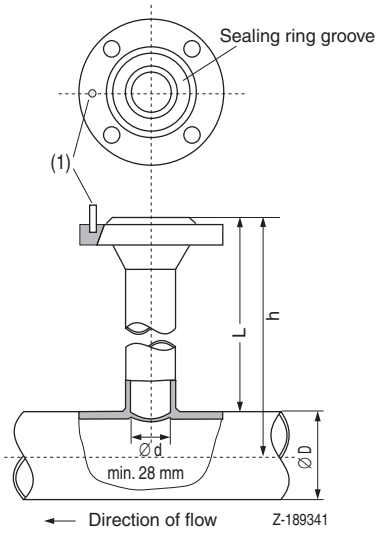
ASME B 16.5, Cl. 150 (ANSI), Sch 40 S

1“	B1= 125	269	263	–	26.6	–	108	560	454	–
1½“	B2 = 80			85	40.9	73	127	864	741	–
2“	B3 = Ø115			103	52.6	92	154	1003	846	–
3“	B4 = 58			135	78.0	127	–	–	–	–
4“	K1 = 150			173	102.4	157	–	–	–	–
6“	K3 = 206			221	154.2	216	–	–	–	450
8“	L1 = 188			278	202.7	270	–	–	–	
> 14“	L6 = 310	431	425							
> 28“	M1 = 208	781	775							
	M2 = 265									
	M3 = 139									

ASME B 16.5, Cl. 300 (ANSI), Sch 40 S

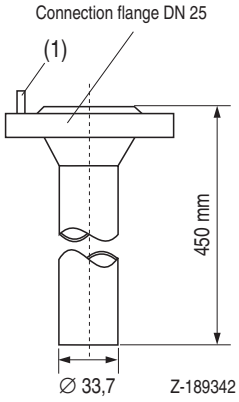
1“	B1= 125	269	263	–	26.6	–	123.9	560	454	–
1½“	B2 = 80			94	40.9	73	155.4	864	741	–
2“	B3 = Ø115			110	52.6	92	165.1	1003	846	–
3“	B4 = 58			148	78.0	127	–	–	–	–
4“	K1 = 150			180	102.4	157	–	–	–	–
6“	K3 = 206			249	154.2	216	–	–	–	450
8“	L1 = 188			307	202.7	270	–	–	–	
> 14“	L6 = 310	431	425							
> 28“	M1 = 208	781	775							
	M2 = 265									
	M3 = 139									

Weld-on adapter for FMT500-IG (Sensyflow iG)



(1) Centering pin on outlet run side

Weld-on adapter (upon delivery)



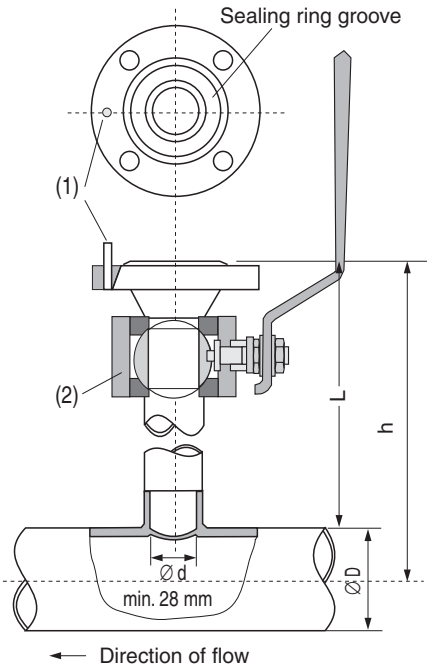
Required accuracy of mounting

Centric mounting < ± 2 mm
Twist < ± 2°

Length h of the transducer (in mm)	**Min./max. outer pipe diameter** (in mm)
263	100...350
425	> 350...700
775	> 700...1400*

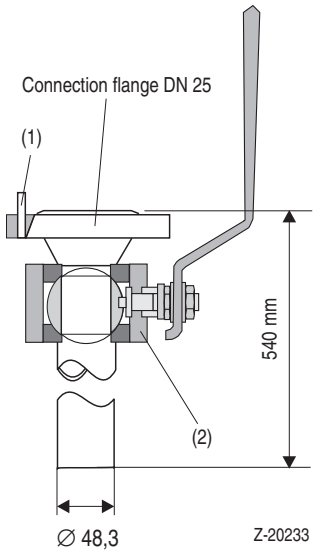
* This maximum pipe diameter specification is only valid when installing the sensor centrically in the pipe. For larger diameters or angular ducts a non-centric sensor position is assumed for calibration.

Weld-on adapter with ball valve for FMT500-IG (Sensyflow iG)



(1) Centering pin on outlet run side
(2) Ball valve DN 40
D Pipe diameter (outside)

Weld-on adapter (upon delivery)



Required accuracy of mounting

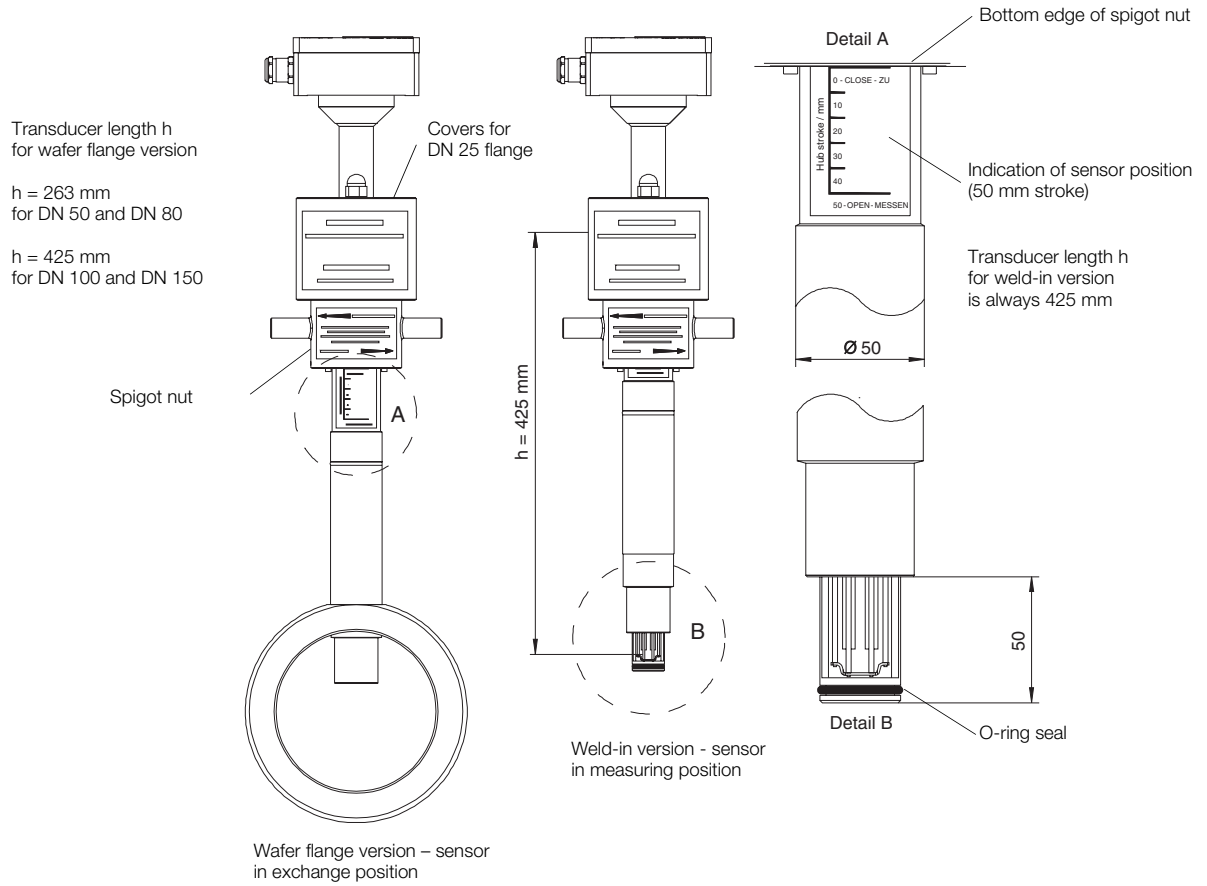
Centric mounting < ± 2 mm
Twist < ± 2°

Length h of the transducer (in mm)	**Min./max. outer pipe diameter** (in mm)
263	100...150
425	> 150...500
775	> 500...1150*

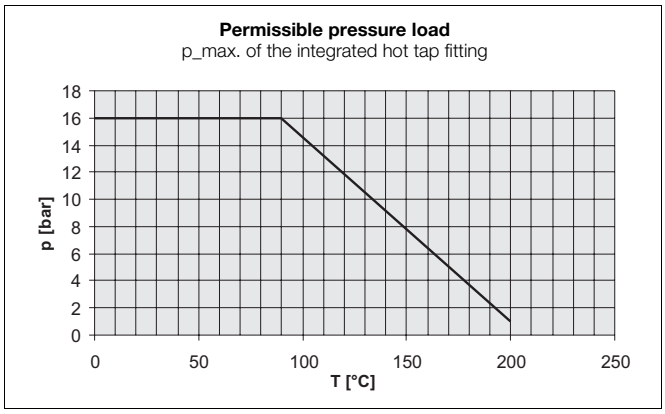
* This maximum pipe diameter specification is only valid when installing the sensor centrically in the pipe. For larger diameters or angular ducts a non-centric sensor position is assumed for calibration.

Note:
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.
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).

Integrated hot tap fitting for FMT500-IG (compact and remote versions)



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

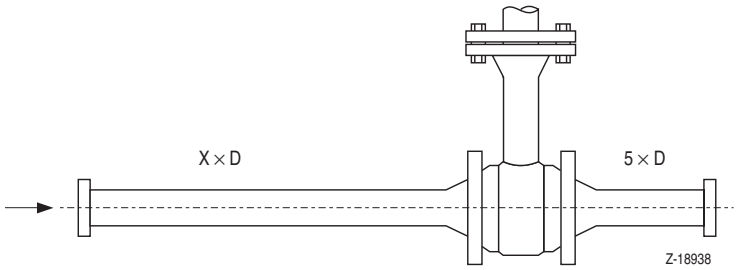


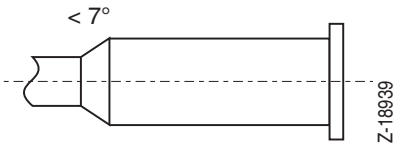
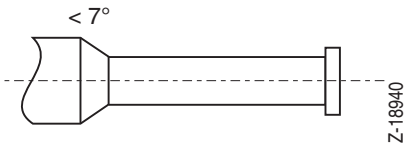
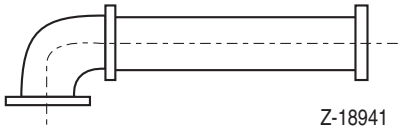
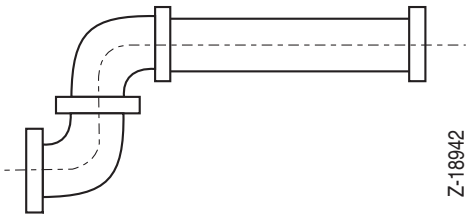
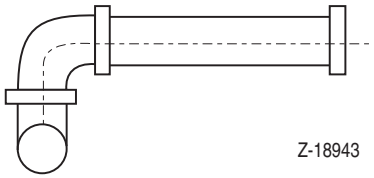
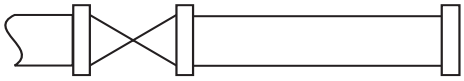
Maximum pressure/temperature values for the integrated hot tap fitting

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 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 sensor.

Handling:
The transmitter in a compact or remote version is screwed to the hot tap fitting through the DN 25 flange. Then the cover is put on. The sensor 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 position (see Detail A, sensor is in exchange position). Only when the measuring position 50 - OPEN-MESSEN (lower stop of the spigot nut) is reached, the sensor is placed exactly in the center of the pipe and exact measurement is ensured.

Recommended steadying lengths according to DIN EN ISO 5167-1



	Expansion X = 15
	Reducer X = 15
	90° elbow X = 20
	Two 90° elbows in one level X = 25
	Two 90° elbows 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, consult the DKD Calibration Department at Alzenau.
For gases with extremely low density (hydrogen, helium) the steadying lengths must be doubled.

Ordering information

														Code		
Transducer FMT500-IG			**V14224-**													
Versions																
Standard		-25...+150 °C		1												
High-temperature version		-25...+300 °C		2												
ATEX version for Zone 2 / 22		-20...+150 °C	1)	3												
ATEX version for Zone 1 / 21		-20...+150 °C max.	2)	4												
ATEX version for Zone 0 / 21		-20...+ 80 °C		5												
Medium																
Gases and gas mixtures, natural gas without DVGW certificate					A											
Oxygen with O_2 certificate					B											
DVGW certificate for natural gas					C											
H_2, He (1.5 MPa max.; always with process gas calibration)			3) 4)		D											
Sensor unit																
Standard ceramic sensor						1										
Material 1.4571																
Mounting length	263 mm	(DN 25... DN 350)	5)				1									
Mounting length	425 mm	(> DN 350...DN 700)	5)				2									
Mounting length	775 mm	(> DN 700)	5)				3									
Power supply																
Universal power supply:		110...230 V AC/DC ± 10% (f = 48...62 Hz)						1								
Low-voltage power supply:		24 V AC/DC ± 20% (f = 48...62 Hz)						2								
Designs																
Compact design, without display, controlled via interface (under preparation)									0							
Compact design, controlled via magnetic pen and keypad									1							
Remote version w. display, controlled via magn. pen & keypad (cables see access.)			6)						2							
Communication																
Analog signal / HART										1						
PROFIBUS DPV1, direct connection of bus cable										2						
PROFIBUS DPV1, with DP M12 connector socket (for non-Ex compact versions, only)										3						
Cable glands (enclosed)																
Metric, M20 x 1.5											1					
½" NPT											2					
Number of characteristics																
1 characteristic												1				
2 characteristics												2				
3 characteristics												3				
4 characteristics												4				
Calibration certificate																
Factory certificate													0			
DKD certificate for calibration with air (in in-house calibration lab.)													1			
(DKD calibration office No. 05701, PTB-approved) (not for process gas calibration)																
Material certificate																
Without														0		
3.1 B certificate														1		

1) manufacturer's declaration
2) depending on temperature class T4...T1, for T4/T3 max. 100 °C, max. gas temperature 150 °C
3) process gas calibration for other gases/gas mixtures on request
4) with measured medium H_2 or He in nominal size DN 25/40 or 1"/1 1/2"
please use pipe components design 2 with flow straightener
5) nominal size ranges when using pipe components or weld-on adapters without ball valve
6) with ATEX versions: wall housing with operating electronics, can be mounted in Ex zone 2

Accessories

	Catalog No.	Code		
Special cable between transducer and evaluation unit				
Ready-made, for remote version only				
Cable length 5 m	7962844			
Cable length 15 m	7962845			
Cable length 25 m	7962846			
PROFIBUS DP-T connector plug	7962847			
PROFIBUS DP socket, for customizing the bus cable	7962848			
PROFIBUS DP connector, for customizing the bus cable	7962849			
For T-pieces and DP connectors see data sheet 10/63-6.44 EN				
PROFIBUS DTM)				
PROFIBUS PDM (Siemens) on request) see data sheet 10/63-1.20 EN				
HART DTM)				

Ordering information

				Catalog No.				Code		
Pipe component design 2 for FMT500-IG partial measuring section				**V14233-**						
PN 40, material stainless steel 1.4571 (316Ti) (flange shape B1 according to EN 1092-1)										
Nominal size	DN 25	Inner ∅	28.5	1)	1	1	0			
Nominal size	DN 40		43.1		1	2	0			
Nominal size	DN 50		54.5		1	3	0			
Nominal size	DN 25 with flow straightener		28.5	1)	1	4	0			
Nominal size	DN 40 with flow straightener		43.1	1)	1	5	0			
Connecting dimensions for flanges according to ASME B16.5, CL 150 (ANSI), Sch 40 S, material stainless steel 1.4571 (316Ti)										
Nominal size	1"	Inner ∅	26.6	1)	2	A	0			
Nominal size	1 1/2"		40.9		2	B	0			
Nominal size	2"		52.6		2	C	0			
Nominal size	1" with flow straightener		26.6	1)	2	D	0			
Nominal size	1 1/2" with flow straightener		40.9	1)	2	E	0			
Connecting dimensions for flanges according to ASME B16.5, CL 300 (ANSI), Sch 40 S, material stainless steel 1.4571 (316Ti)										
Nominal size	1"	Inner ∅	26.6	1)	3	A	0			
Nominal size	1 1/2"		40.9		3	B	0			
Nominal size	2"		52.6		3	C	0			
Nominal size	1" with flow straightener		26.6	1)	3	D	0			
Nominal size	1 1/2" with flow straightener		40.9	1)	3	E	0			

Additional ordering information

	Code		
3.1 B Certificate material certificate (only for pipe component)	30A		

Ordering information

	Catalog No.		
Weld-on adapter PN 40 for FMT500-IG recommended from DN 150			
Material			
stainless steel 1.4571 (316Ti)	7962500		
1.0037	7962502		
Weld-on adapter with ball valve/hot tap fitting for FMT500-IG material stainless steel 1.4571 (316Ti)			
Weld-on adapter with ball valve for pressureless, non gas-tight applications	7962832		
Weld-on adapter with integrated hot tap fitting for nominal size DN 100 to DN 125/4“ to 5“ and transducers of 425 mm, for pressure applications up to 16 bars and gas-tight applications, material 1.4571	7964131		
Weld-on adapter with integrated hot tap fitting for nominal size DN 150 to DN 300/6“ to 12“ and transducers of 425 mm, for pressure applications up to 16 bars and gas-tight applications, material 1.4571	7964132		
Special pipe component for transducer FMT500-IG			
call			
Description:"..... ....."			
3.1 B Certificate material certificate (only for pipe component)	7962839		

1) In order to achieve the specified measuring accuracy, the calibration of the transducer must be performed in the original pipe component. If the transducer needs to be re-calibrated, it must be submitted together with the same pipe component.

Ordering information

		Catalog No.						Code		
Pipe component design 1 for FMT500-IG wafer flange version		**V14232-**								
PN 40, material stainless steel 1.4571 (316Ti)	Inner ∅ (mm)									
Nominal size DN 40	43.1		1	2	0					
Nominal size DN 50	54.5		1	3	0					
Nominal size DN 80	82.5		1	4	0					
Nominal size DN 100	107.1		1	5	0					
Nominal size DN 150	159.3		1	6	0					
Nominal size DN 200	206.5		1	7	0					
Connecting dimensions for flanges according to ASME B16.5, CL 150 (ANSI), Sch 40 S, material stainless steel 1.4571 (316Ti)										
Nominal size 1 1/2"	40.9		2	B	0					
Nominal size 2"	52.6		2	C	0					
Nominal size 3"	78.0		2	D	0					
Nominal size 4"	102.4		2	E	0					
Nominal size 6"	154.2		2	F	0					
Nominal size 8"	202.7		2	G	0					
Connecting dimensions for flanges according to ASME B16.5, CL 300 (ANSI), Sch 40 S, material stainless steel 1.4571 (316Ti)										
Nominal size 1 1/2"	40.9		3	B	0					
Nominal size 2"	52.6		3	C	0					
Nominal size 3"	78.0		3	D	0					
Nominal size 4"	102.4		3	E	0					
Nominal size 6"	154.2		3	F	0					
Nominal size 8"	202.7		3	G	0					
Ball valve or hot tap fitting										
without						0				
Pipe component with ball valve for pressureless applications, non gas-tight material stainless steel 1.4571 (316Ti)						1				
Pipe component with integrated hot tap fitting for nominal size DN 50 or DN 80 (2"/3") and transducer of 263 mm, for pressure applications up to 16 bars and gas-tight applications, material stainless steel 1.4571 (316Ti), flanges PN 40						4				
Pipe component with integrated hot tap fitting for nominal size DN 100 or DN 150 (4"/6") and transducer of 425 mm, for pressure applications up to 16 bars and gas-tight applications, material stainless steel 1.4571 (316Ti), flanges PN 40						5				

Additional ordering information

	Code		
3.1 B Certificate material certificate (only for pipe component)	30A		

Additional ordering information for calibration

	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4		
Code-No. 1) Name of gas	511	521	531	541		
Gas component 1 Vol %						
Gas component 2 Vol %						
Gas component 3 Vol %						
Gas component 4 Vol %						
Gas component 5 Vol %						
Gas component 6 Vol %						
Gas component 7 Vol %						
Gas component 8 Vol %						
Gas component 9 Vol %						
Gas component 10 Vol %						
Code-No. 1) Operating temperature °C	512	522	532	542		
Code-No. 1) Operating pressure bar abs.	513	523	533	543		
Code-No. 1) Measuring range	514	524	534	544		
Code-No. Unit 2)	515	525	535	545		
Code-No. 1) Nominal size DN Nom. pressure PN Pipe inner ∅ (mm)	518	528	538	548		
Code-No. 1) Standard conditions °C, mbar abs.	519	529	539	549		
Display and menu language (delivered state)	☐ German	☐ English	☐ French	☐ Portuguese		
Material of the connected pipes						

1) Add the 3-digit Code No to the Catalog No.

2) Available flow rate units see table, standard: kg/h, Nm^3/h

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	SCFM	SCFS

Design data

1. Measuring task

2. Measuring point parameters

Gas type and composition (Vol %)[1]				Flow rate units[2] kg/h9 . . . . . ❑ kg/min . . . . . ❑ kg/s . . . . . ❑ Nm^3/h . . . . . ❑ Nl/s . . . . . ❑ Lb/h . . . . . ❑ Lb/min . . . . . ❑ SCFM . . . . . ❑ SCFH . . . . . ❑ SCFS . . . . . ❑ Others . . . . . ❑
Measuring range min.....	normal	max		
Medium temperature (°C) min.....	normal	max		
Operating pressure (bar abs.) min.....	normal	max		
Pipe: nominal width DN	Nominal pressure PN . .	Internal pipe ∅ (mm)	Wall thickness (mm)	
Gas contains corrosive substances	no. . . . . ❑	yes . . . . . ❑	which	Pipe material . . . . .
Gas contains components that tend to condensate	no. . . . . ❑	yes . . . . . ❑	which	Dew point (°C) . . . . .
Medium contains solid particles	no. . . . . ❑	yes . . . . . ❑	Particle size (µm)	Quantity (mg/m^3)[2] . . . . .
Measuring point	First equipment. . . . . ❑	Exchange . . . . . ❑	Old device	

3. Device parameters

Application	**Supply voltage**	**Outputs**
Without explosion protection . . . . . ❑	110...230 V AC/DC . . . . . ❑	Analog/HART + digital . . . . . ❑
With explosion protection for zone 2 . . . . . ❑	24 V AC/DC . . . . . ❑	PROFIBUS DPV1 . . . . . ❑
With explosion protection for zone 1 . . . . . ❑		
With explosion protection for zone 0 . . . . . ❑		
Design	**Pipe components**	**Existing steadying runs[3]**
Compact design . . . . . ❑	Wafer flange . . . . . ❑	Steadying run on the inlet side
Remote version (separate) . . . . . ❑	Partial measuring section . . . . . ❑	. . . . . x D
with cable length 5/15/25 m	Weld-on adapter . . . . . ❑	Steadying run on the outlet side
	Integrated hot tap fitting. . . . . ❑	. . . . . x D

[1] Specify gas mixtures, e.g. natural gas: CH_4 = 90 %; C_2H_6 = 5 %; N_2 = 3 %; CO_2 = 2 %
[2] Standard condition, e.g. referred to 0 °C/1013 mbar
[3] See recommendations on page 15

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Printed in the Fed. Rep. of Germany (03.05)

10/14-6.41 EN Rev. B

ABB Ltd.
Oldends Lane, Stonehouse
Gloucestershire, GL10 3TA
UK
Tel: +44(0)1453 826661
Fax: +44(0)1453 829671

ABB Inc.
125 E. County Line Road
Warminster, PA 18974
USA
Tel: +1 215 674 6000
Fax: +1 215 674 7183

ABB Inc.
3450 Harvester Road
Burlington Ontario L7N 3W5
Canada
Tel: +1 905 681 0565
Fax: +1 905 681 2810

ABB Automation Products GmbH
Borsigstr. 2
63755 Alzenau
Germany
Tel: +49 551 905-534
Fax: +49 551 905-555
CCC-support.deapr@de.abb.com