

Sensyflow FMT200-ECO2 Thermal Mass Flowmeter



Direct mass flow measurement of air

- No additional pressure and temperature compensation required
- Mass flow or standard volume flow measuring values

Wide measuring range of 1:100

High accuracy

Highly dynamic, response time ≤ 90 ms

- Optimized for advanced control systems

Compact design with low weight

No moving parts

- No wear, maintenance-free

Arbitrary mounting orientation

Variable process connections

- Flanges, threads, tubes

Variety of output signals

- Current, voltage, frequency, pulse, alarm, parameter setting via RS 232 interface

Approvals for explosion protection (zone 2 and zone 22)

- Manufacturer's declaration according to ATEX

Applications

- Paint robot control (Air dosing)
- Compressed air systems (Balancing, Leakage detection)

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1 General information

1.1 Principle of operation and construction

Sensyflow FMT200-ECO2 is a compact, highly dynamic measuring system for mass flow or standard volume flow measurement of air.

The device consists of an easy to install pipe component which accommodates the sensor unit and the evaluation electronics. It directly provides a linearized output signal, and it is calibrated and immediately ready for use.

A standard RS 232 interface allows you to change over between the individual output signals (current, voltage, frequency, pulse and alarm) and to configure the device.

Due to its flexible connection concept this measuring instrument can be installed in pipes or tubes of different types and sizes. Various process adapters are available for this purpose.

A standard power supply unit can be used for powering Sensyflow FMT200-ECO2.

Physics of measurement

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

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

Together with the standard density of the gas this results directly in the standard volume flow. Considering the high measuring range dynamics up to 1:100, an accuracy smaller than 1 % of the measuring value is achieved.

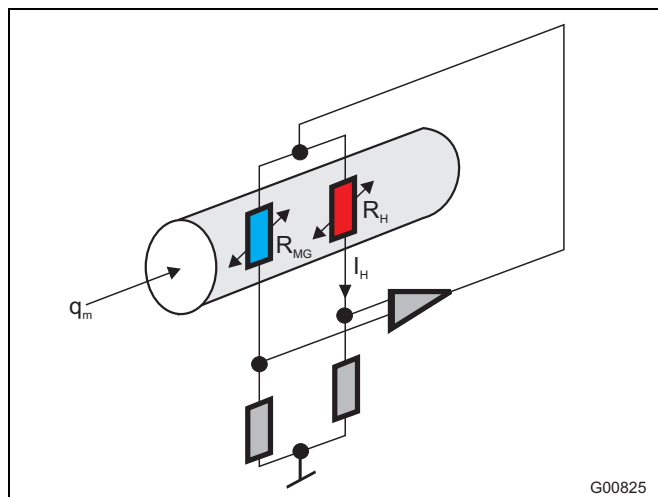


Fig. 1: Analog measuring principle

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

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

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

2 Specifications

Measuring principle

Thermal: hot-film anemometer

Input

Measured medium

Air

Measuring ranges¹⁾

0 (1) ... 100 kg / h or 0 (12) ... 1250 NI / min²⁾

Output

Analog output signal

0 ... 5 V
0 ... 10 V
0 / 4 ... 20 mA

Load

< 500 Ω

Error indication

< 3.5 mA or > 22 mA

Digital output

24 V, 20 mA

Frequency output

variable 1 ... 2500 Hz

Counter pulse

Pulse evaluation and pulse duration configurable

Alarm values

Minimum and maximum, adjustable

Polarity adjustable

Characteristics

Measured error

< ± 3 % of measured value

Repeatability

< ± 0.5 % of measured value

Response time

$T_{63} \approx 25$ ms; $T_{98} \approx 90$ ms

Influences

Temperature effect

< 0.1 % / K of measured value

Pressure effect

≤ 0.2 % / 100 kPa (/bar) of measured value

Pressure drop

< 10 kPa (100 mbar) at full scale and using the small flange adapter DN 25; decreasing quadratically for smaller flow rates.

Environmental conditions

Ambient temperature for flowmeter sensor

0 ... 50 °C (-13 ... 122 °F)

Degree of protection

IP 65

Storage temperature

-25 ... 85 °C (-13 ... 185 °F)

Measured medium conditions

Measured medium temperature

0 ... 50 °C (32 ... 122 °F)

Measured medium pressure

Standard: 10 x 10² kPa (10 bar abs.)
High pressure version: 16 x 10² kPa (16 bar abs.)

Construction

Weight

0.51 kg (accessories see ordering information)

Material

Flowmeter sensor: aluminium, Hostadur, tinned Cu, glass
Process connections: aluminium
Fittings: aluminium

Process connection

Small flange adapter ISO KF flange;
Threads G 3/8", G 3/4", G 1/2", G 1";
Legris tube adapter, Transair adapter

Electrical connection

Sub-D connector, serie 712, 8-pin, IP 65

Power supply³⁾

Voltage

24 V DC ± 10 %

Power consumption

< 15 W

Current consumption

Peak < 1 A; operation < 0.6 A
Slow-blow fuse of at least 2 A recommended

Communication interface

RS 232

Approvals for explosion protection (zone 2 and zone 22)

Gas: ATEX II 3 G EEx n A II T4 X
Dust: ATEX II 3 D T 135 °C IP 65 X

Accessories (optional)

- Inlet and outlet runs
- Pipe fittings
- Connection adapter
- Quick-clamping connectors
- Reducers
- Power supply unit
- Display unit
- Display and supply unit completely installed in an IP 65 housing

- 1) Approximate values are given for applications with air under atmospheric conditions. The values in brackets indicate the low limit of the measuring range for which the measured value accuracy indicated is specified.
- 2) It is possible to specify any unit which you can transform into a mass or standard volume flow. (Can also be written as: l / min-q_n).
- 3) Power supply with safe electrical separation in accordance with EN 61010 and IEC 950, with max. output power of 150 W.

3 Electrical connection

Please use the supplied cable for the electrical connection of the flowmeter sensor. On the measuring unit, a connector is used for the coupling.

Use a 24 V DC power supply with isolation according to EN 61010 and IEC 950 with a maximum output of < 150 W only.

3.1 Cable assignments

Color of cores	Connector pin number	Signal
White	#1	Analog output +
Brown	#2	RS 232 / TxD
Green	#3	Pulse / frequency output
Yellow	#4	Power supply 24 V DC
Grey	#5	Power supply 0 V
Pink	#6	RS 232 / RxD
Blue	#7	GND / analog
Red	#8	GND / frequency + pulse + RS 232
Shielding	-	Functional earthing

3.2 Circuiting the signal outputs

3.2.1 Analog output

Upon selection, the analog output of the current output supplies an active signal of 0 (4) ... 20 mA, i. e. the Sensyflow FMT200-ECO2 device supplies the current independently.

For this reason, do not use a 2-wire power supply unit or an active input of a PLC, but rather a passive signal receiver.

3.2.2

Digital output

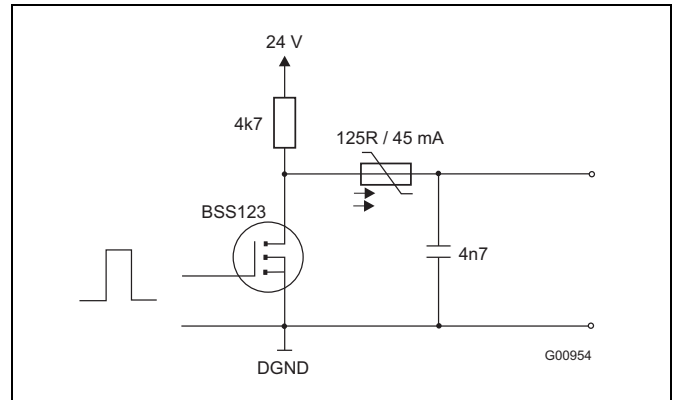


Fig. 2: Digital output

The digital output offers a 24 V = HIGH signal or a 0 V = LOW Signal. The digital output can be used as active or passive output.

Active digital output wiring

The output current in the HIGH-mode must be limited to 1 mA when the active digital output is used (passive signal receiver). This is to ensure an output voltage $U_a > 15$ V.

Passive digital output wiring

Using the passive output (active signal receiver), the output current in the LOW-mode must be limited to -20 mA. This is to ensure an output voltage $U_a < 2.5$ V.

3.2.3 Compatibility to Sensyflow eco1

Sensyflow eco1 und Sensyflow FMT200-ECO2 are compatible. Using the appropriate electrical adapter, FMT200-ECO2 can be connected to existing plants.

As "interface" and "digital output" functionality is not available with Sensyflow eco1, there is no wiring within the adapter for these functions.

4.2 Service and parameterization box

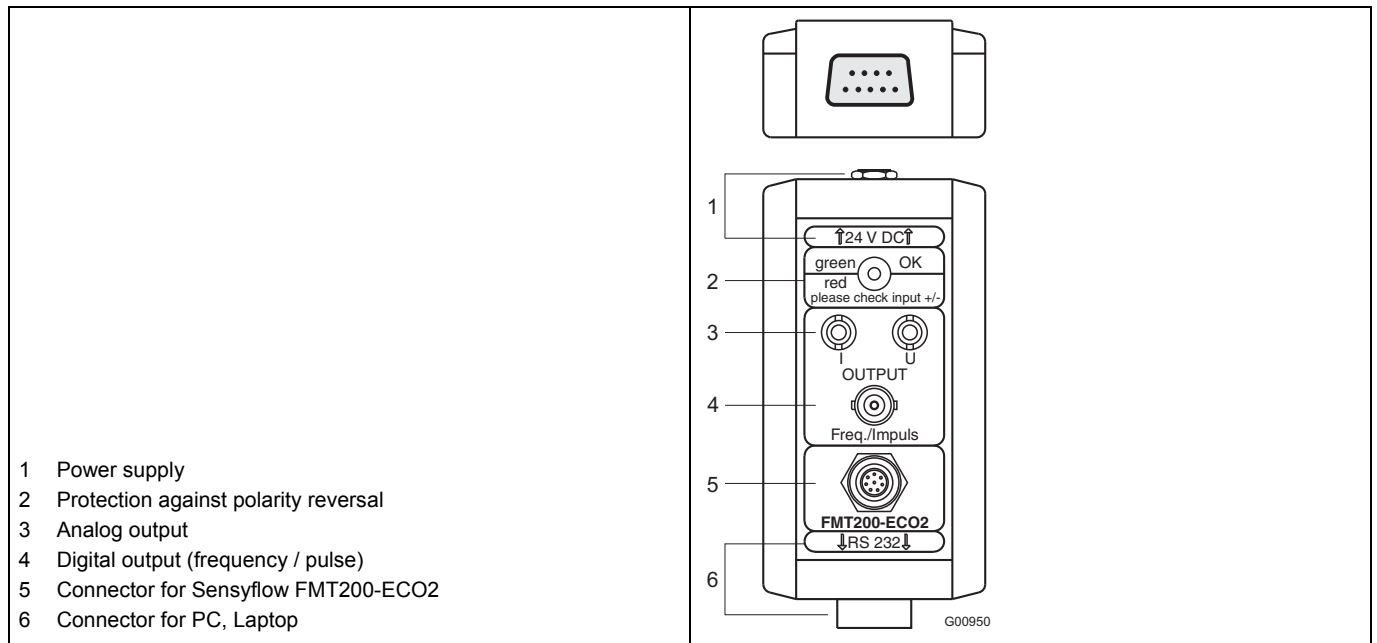


Fig. 3

5 Dimensions

5.1 Flowmeter sensor FMT200-ECO2

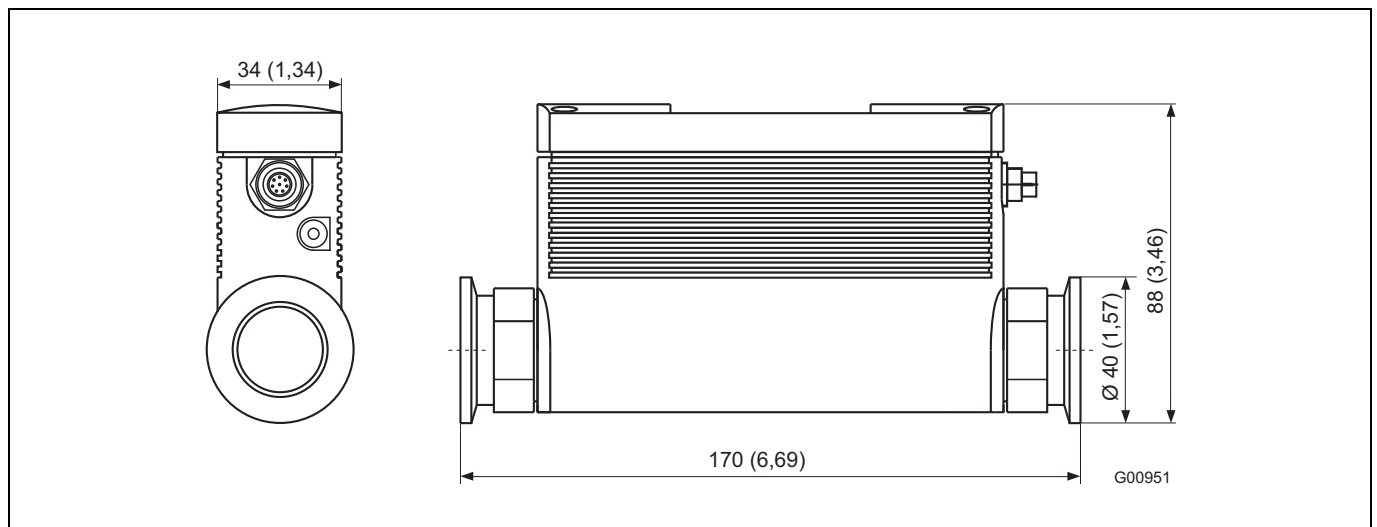
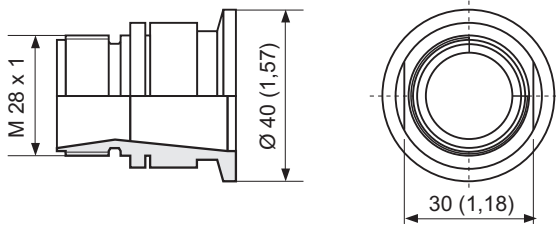


Fig. 4: Flowmeter sensor FMT200-ECO2 with mounted small flange process adapter

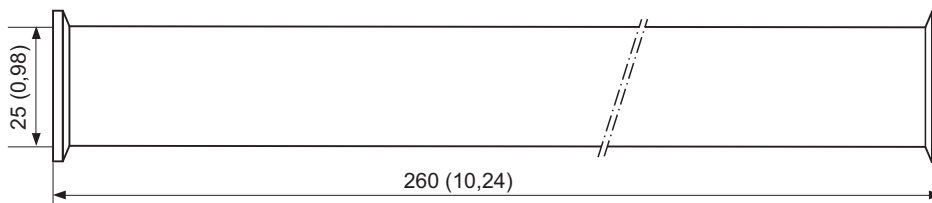
5.2 Accessories

Small flange connections

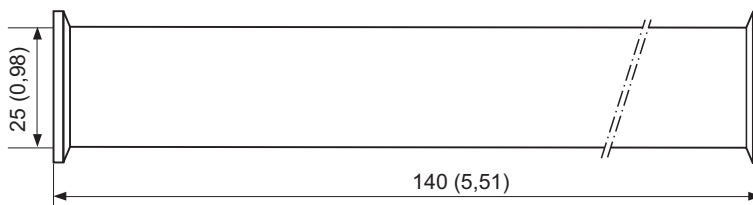
KF = ISO KF flange (ISO small flange)



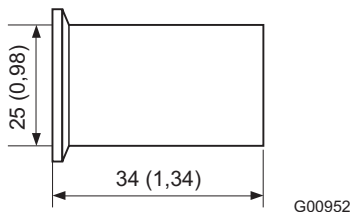
Process adapter flange KF DN 25, inlet run and outlet run, 2 clamp rings and 2 sealing rings



Inlet run length 10 x D, both sides with KF-DN 25 connections



Outlet run length 5 x D, both slides with KF DN 25 connections



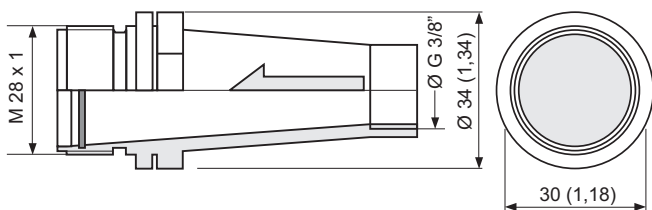
Hose adapter for KF DN 25, incl. 1 flange, 1 clamping ring and 1 sealing ring

Fig. 5: Dimensions in mm (inch)

Straight undisturbed pipes must be provided as steadying lengths. On the inlet side they should have a length of approx. 10 x D. When using the G 1/2" and G 3/8" adapters no additional steadying lengths are required, as flow-conditioning components are implemented in the adapters on the inlet side.

Note that flow conditioner causes a considerable pressure drop. Components affecting the flow like valves or shut-off devices should be installed on the outlet side, i. e. downstream of the measuring point.

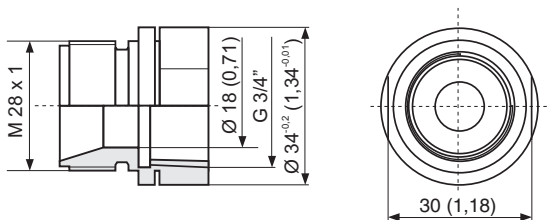
Threads and adapter



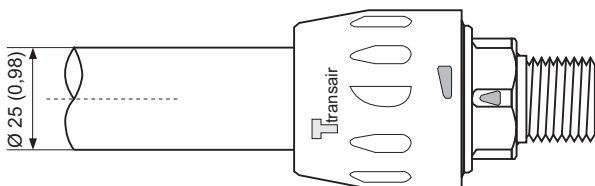
Thread G 3/8", connection for Legris-tube adapters, pair for inlet run and outlet run; inlet run adapter includes a high-tech flow conditioner



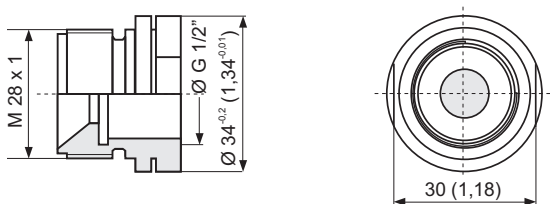
Legris-tube adapter (pair)



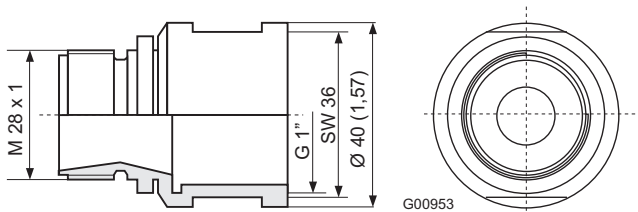
Thread G 3/4", also connection for Transair system 25 mm (pair)



Transair adapter 25 mm (pair)



Thread G 1/2" (pair) for inlet run and outlet run. Inlet run adapter includes a high-tech flow conditioner



Thread G 1"

Fig. 6: Dimensions in mm (inch)

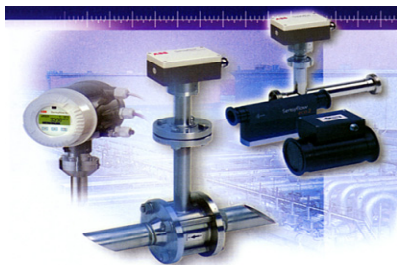
	Main Code						Add. Code	
	Variant digit No.	1 - 6	7	8	9	10		11
Sensyflow FMT200-ECO2 Thermal Mass Flowmeter, for Air, Compact	V14252			X	X	X	X	XXX
Calibration Type / Operating Pressure								
Standard calibration 0 ... 100 kg/h (0 ... 220 lb/h) / Operating pressure 1 ... 10 bar abs. (0.1 ... 1 MPa abs. / 14.5 ... 145 psi abs.)			1					
Standard calibration 0 ... 100 kg/h (0 ... 220 lb/h) / High pressure version, operating pressure 10 ... 16 bar abs. (1 ... 1.6 MPa abs. / 145 ... 232 psi abs.)			2					
Customer specific calibration, operating pressure 1 ... 10 bar abs. (0.1 ... 1 MPa abs. / 14.5 ... 145 psi abs.)	2)		3					
Customer specific calibration, high pressure version, operating pressure 10 ... 16 bar abs. (1 ... 1.6 MPa abs. / 145 ... 232 psi abs.)	2)		4					
Analog Output								
0 ... 5 V			1					
0 ... 10 V			2					
0 ... 20 mA, alarm > 22 mA			3					
4 ... 20 mA, alarm < 3.5 mA			4					
4 ... 20 mA, alarm > 22 mA			5					
Digital Output								
Counter pulse output (high level)			1)	1				
Counter pulse output (low level)			1)	2				
Frequency output, adjustable up to 2500 Hz			3)	4				
Alarm output (alarm = high)			4)	5				
Alarm output (alarm = low)			4)	6				
Process Connection								
1 pair of process adapters KF DN 25 (1 in.), incl. 2 clamping rings and 2 sealing rings							1	
1 pair of threads G 3/8 in., also connection for Legris-section adapters, outlet run adapter includes a high-tech flow straightener							2	
1 pair of threads G 1/2 in.							3	
1 pair of threads G 3/4 in., also connection for Transair system 25 mm, outlet run adapter includes a high-tech flow straightener							4	
1 pair of threads G 1 in.							5	
Version								
Standard							0	
ATEX version for Zone 2 / 22							1	
Language of Documentation								
German								M1
French								M4
English								M5

Accessories	Code
SMD130 DKD Calibration of Thermal Mass Flowmeters, certificate of calibration with air, PTB approved DKD calibration facility No. 05701	3KXS310130S1001
FMT Power supply unit, housing for rail mounting 62.5 mm x 75 mm x 139 mm, input 230 V AC, output 24 V DC / 2.5 A	7962800

- 1) State pulse evaluation with code no. 310. The digital output can have states High = 24 V or Low = 0 V.
Please specify the required polarity
- 2) Customer specific configuration: measuring range, unit of measure, normalization conditions, upper measuring range value
acc. code nos. 110 and 114
- 3) Standard 10 ... 1000 Hz
- 4) State alarm values with code nos. 312 ... 313

Accessories	Code
FMT200-ECO2 Small Flange connections FMT200-ECO2 process adapters ISO KF flange DN 25, for entry and exit, incl. 2 clamping rings and 2 sealing rings FMT200-ECO2 process connections, entry length 10 x D both sides with ISO KF flanges DN 25 connections FMT200-ECO2 process connections, exit length 5 x D both sides with ISO KF flanges DN 25 connections FMT200-ECO2 process connections, clamping ring and seal for ISO KF flanges DN 25 connection FMT200-ECO2 process connections, hose adapter ISO KF DN 25, flange, 1 clamping ring and 1 sealing ring	7962850 7962801 7962802 7962809 7962803
FMT200-ECO2 Threads and Adapter FMT200-ECO2 thread G 3/8 in., pair for entry and exit, also connection for Legris-section adapters; outlet run adapter includes a high-tech flow straightener FMT200-ECO2 Legris-section adapter, 8 mm, pair for entry and exit FMT200-ECO2 Legris-section adapter, 10 mm, pair for entry and exit FMT200-ECO2 Legris-section adapter, 12 mm, pair for entry and exit FMT200-ECO2 Legris-section adapter, 14 mm, pair for entry and exit FMT200-ECO2 thread G 3/4 in., pair for entry and exit, also connection for Transair system 25 mm; outlet run adapter includes a high-tech flow straightener FMT200-ECO2 Transair adapter 25 mm, pair for entry and exit FMT200-ECO2 thread G 1/2 in., pair for entry and exit FMT200-ECO2 thread G 1 in., pair for entry and exit	7962851 7962855 7962856 7962857 7962858 7962853 7962812 7962852 7962854
FMT200-ECO2 Installation Accessories FMT200-ECO2 additional connecting cable, 5 m with 1 plug FMT200-ECO2 service and configuration box FMT200-ECO2 electrical adapter, for connecting cable type eco 1 to FMT200-ECO2, length approx. 20 cm FMT200-ECO2 installation adapter for busbar mounting	7962817 7962818 7962819 7962816
FMT200-ECO2 Complete Set FMT200-ECO2 complete set, suitcase with FMT200-ECO2 with standard calibration	7962814

6 Questionnaire



Questionnaire
Thermal Mass Flowmeter
Sensyflow FMT

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

Media data for gaseous, pure media:

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

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

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

Flow unit:

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

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

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

Required device designs:

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

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

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

Design: 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) CH₄ 90%, 2) C₂H₆ 5%, 3) N₂ 3%, 4) C₃H₈, 1%, 5) CO₂ 1%).
 2) Calibration is performed at the max. possible flow in the nominal size specified.
 3) Please observe/determine the minimum inflow and outflow sections.
 4) Output signal: 0...10 V as standard

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

Contact us

ABB Ltd.

Oldends Lane, Stonehouse
Gloucestershire, GL10 3TA
UK

Phone: +44 (0)1453 826661

Fax: +44 (0)1453 829671

ABB Inc.

125 E. County Line Road
Warminster PA 18974
USA

Phone: +1 215 674 6000

Fax: +1 215 674 7183

ABB Automation Products GmbH

Dransfelder Str. 2
37079 Goettingen
Germany

Phone: +49 551 905-534

Fax: +49 551 905-555

www.abb.com

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